passive house+

eco build & upgrade

Cabin fever

Japanese-inspired passive mountain lodge

Straw bale house

Near passive, no heating system

insulation | airtightness | renewable energy | triple-glazing | ventilation | green materials | water conservation + more

Issue 19 £3.95
UK EDITION
ISSN 2009-597X

Just INCAse...

...always demand the quality you need

When choosing an insulation or cladding firm, you need to know your partner won't let you down. To become an Insulated Render & Cladding Association (INCA) member, every firm must demonstrate that they have the same high standards of competence we do on every single project. So the next time you choose a partner, look for the INCA logo. Demand an INCA member... Just in case.

#justINCAse

INCA members must meet recognised standards of competence.

INCA. Just INCAse.
Call 0844 249 0040 or visit www.inca-ltd.org.uk

editor's letter

Post-truth was voted word of the year 2016 by the Oxford Dictionaries, an adjective defined as 'relating to or denoting circumstances in which objective facts are less influential in shaping public opinion than appeals to emotion and personal belief'. We could not find a more depressingly apt footnote to a year that culminated in the election of improbably coiffured, sunbed demagogue Donald Trump as leader of the free world, a man with a pathological allergy to speaking the truth. This, let us remember, was the year when Brexit campaigner Michael Gove rebuffed a question on whether he could name any economists who backed Brexit by saying that "people in this country have had enough of experts". So it shouldn't surprise us that if the zeitgeist is to value glib soundbites that reinforce existing prejudices over reasoned, factual debate, we can detect signs of this in the construction sector.

Gove's assertion smacked of opportunistic populism, but it brings me to an interesting point. One of the best things Gove did as education secretary was appoint medical doctor and journalist Ben Goldacre to look at how to improve the use of evidence in schools, drawing from transferable lessons learnt from modern medicine for the paper he produced, Building Evidence into Education:

> *Doctors didn't invent evidence based medicine. In fact, quite the opposite is true: just a few decades ago, best medical practice was driven by things like eminence, charisma, and personal experience. We needed the help of statisticians, epidemiologists, information librarians, and experts in trial design to move forwards. Many doctors – especially the most senior ones – fought hard against this, regarding "evidence based medicine" as a challenge to their authority.*
>
> *In retrospect, we've seen that these doctors were wrong. The opportunity to make informed decisions about what works best, using good quality evidence, represents a truer form of professional independence than any senior figure barking out their opinions.*

If we want to build better buildings – buildings that are robustly built, comfortable, healthy and cheap to run, while doing their bit in terms of minimising damage to the environment and to climate in particular, we would do well to heed these words. The industry has historically been very poor at collating and analysing evidence on how buildings perform, and our authority figures have long preached general principles without evidencing their worth. That's how we've arrived at a situation where the most common approaches to ventilation of dwellings are not supported by evidence, and not fit for purpose for low energy buildings. That's why the European Commission wrote to member states in July warning them that efforts to meet the EU's nearly zero energy building targets risked being undermined by a performance gap, and called for calculated energy performance to be calibrated against actual usage, while also flagging the risk that indoor air quality in NZEBs may be compromised due to inadequate ventilation.

2017 could be the year where we finally start to tap into the enormous opportunities presented by evidence-based construction. We're witnessing an explosion in the development of monitoring and data logging equipment, which could provide invaluable evidence if we have the presence of mind to pool and analyse the data, to put it in the hands of constructional epidemiologists, as it were. And we must do this, or suffer the consequences. Our international obligations to tackle climate change are forcing profound changes to how we build, whether we like it or not. The question is whether our attempts at sustainable construction result in buildings that endure, or in expensive, widespread mistakes that could so easily have been avoided had we been paying attention to the evidence.

Regards,
The editor

AECB building knowledge

FSC www.fsc.org MIX Paper from responsible sources FSC® C015417

International PASSIVE HOUSE Association

iPHA

An official partner magazine of The International Passive House Association

Passivhaus Trust
The UK Passive House Organisation

Official partner magazine of:
The Association for Environment Conscious Building
The International Passive House Association
The Passivhaus Trust

Issue 19

PUBLISHERS: Temple Media Ltd.
PO Box 9688, Blackrock, Co. Dublin, Ireland
T: +353 (0)1 2107513 / +353 (0)1 2107512
Email: info@passivehouseplus.ie
www.passivehouseplus.co.uk

EDITORIAL


EDITOR:
Jeff Colley
E: jeff@passivehouseplus.ie


DEPUTY EDITOR:
Lenny Antonelli
E: lenny@passivehouseplus.ie


REPORTER:
John Hearne
E: john@passivehouseplus.ie

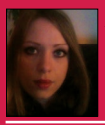

REPORTER:
Kate de Selincourt
E: kate@passivehouseplus.ie


REPORTER:
John Cradden
E: cradden@passivehouseplus.ie


UK SALES
Stephen Molyneux
E: stephen@passivehouseplus.co.uk


READER RESPONSE / IT
Dudley Colley
E: dudley@passivehouseplus.ie


ACCOUNTS
Oisin Hart
E: oisin@passivehouseplus.ie


ART DIRECTOR
Lauren Colley
E: lauren@passivehouseplus.ie

CONTRIBUTORS

Ben Adam-Smith, journalist | Pat Barry, Irish Green Building Council Fran Bradshaw, Anne Thorne Architects | Nessa Duggan, Rightify Simon McGuinness, Simon McGuinness Architects | Andrew Michler, designer | Peter Rickaby, Rickaby Thompson Associates

GRAPHIC DESIGN:
www.evekudesign.com

PRINTING: GPS Colour Graphics,
T: +44 (0) 28 9070 2020
www.gpscolour.co.uk

Publisher's circulation statement: Passive House Plus (UK edition) has a growing print run of 11,000 copies, posted to architects, clients, contractors & engineers. This includes the members of the Passivhaus Trust, the AECB & the Green Register of Construction Professionals, as well as thousands of key specifiers involved in current & forthcoming sustainable building projects.

Cover: Passive House mountain cabin, Colorado
Photo: Andrew Michler

ABC

ABC Certified Average Net Circulation of 9,566 for the period 01/07/15 to 30/06/16

ThermProtect reduces overheating in solar thermal collectors

Our intelligent ThermProtect absorber coating limits the effect of stagnation at temperatures above 75°C, where damage to the solar system usually occurs.

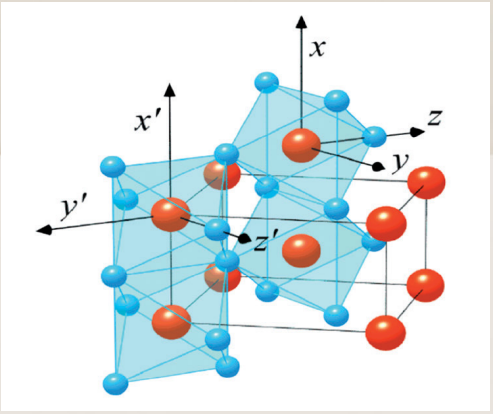
Additionally as no high temperature emergency shut-down is needed, Vitosol solar heat remains available at all times, ensuring higher performance.

ThermProtect is only available from Viessmann.

- High performance flat-plate collectors with switching ThermProtect absorber layer
- No overheating or vapour formation in the case of low heat demand
- Higher solar coverage for central heating backup and DHW heating
- Universally suitable for above roof installation, roof integration, flat roof installation, or wall mounting

For more information please see our website or email us at, info-uk@viessmann.com

www.viessmann.co.uk/thermprotect



From 75°C the surface changes its structure to increase heat emission to prevent collector damage.

Heating Systems ◄
Industrial Systems
Refrigeration Systems

VIESMANN
climate of innovation

Viessmann Limited • Telford • Telephone 01952 675000

contents

HS330 LIFT & SLIDE DOOR

U_D 0.67

- Slider upto 3.2m H x 3.0m W
- 54mm Triple Glazed
- Large Scale Glazing
- PassivHaus Compliant
- Glass to glass corners/joins

ecoHaus
Internorm

INTERNORM'S MOST COMPETITIVE GUARANTEED

INTERNORM'S NO1 UK PARTNER 2012-2015

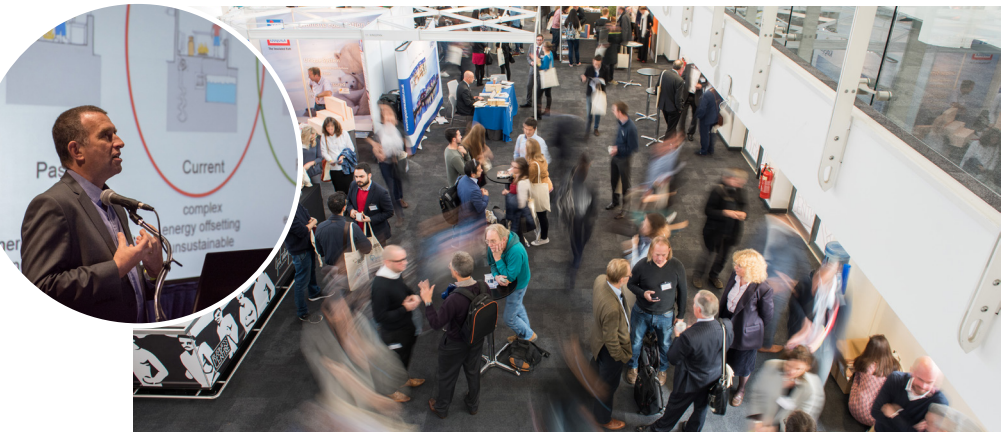
SALES, SURVEY & INSTALLATION – NATIONWIDE

tel: **0800 612 6519**
web: **www.ecohausinternorm.com**
email: **sales@ecohausinternorm.com**

Architects: Loyn & Co, RIBA Award Winning

News

2016 UK Passivhaus Conference gets into detail on delivery



2016's UK Passivhaus Conference, which took place in London in October, was the biggest yet, with 300 delegates and another 100 visitors to the expo that ran in parallel. Also in attendance were students from half a dozen architecture schools, some of whom had risen before dawn for the chance to attend.

The focus of the conference was on how to deliver the passive house standard. Conference and Passivhaus Trust chair Chris Herring, and Passivhaus Trust chief executive Jon Bootland, were both confident that passive house was entering the big time in the UK. "This is an exciting moment for passive house — it is just starting to touch the mainstream, and engaging mainstream firms," Jon Bootland said.

The fact that mainstream developers and contractors are now looking to achieve passive house, was both essential and potentially dangerous, Chris Herring said. He was echoed by Sally Godber of Warm. who commented: "Promoting passive house in the mainstream is a bit scary, it takes us outside our comfort zone, but we have to do this."

"The challenges are not just technical, they are also cultural," Chris Herring explained. "Passive house needs a culture of collaboration and openness to develop throughout the industry – not currently a feature here."

The conference also heard insights from both seasoned passive house designers and clients – but invaluably, also from contractors. The clear message was that passive house requires extra effort. And the extra effort needs to be planned in right from the start, to avoid unnecessary costs, delays and frustration.

As Emma Osmundsen of Exeter City Council – who have pledged to build only to the passive house standard – explained: "You want all the professionals involved to recognise that passive house requires something extra, to accept that it does take longer both at the design stage, and on site, and costs will be higher, so the client can have realistic expectations. Give the client a realistic programme. They need to know."

A more open and less adversarial approach was urged by everyone who spoke on the subject. Collaboration releases creativity – and releases savings. But people will only feel confident in sharing their ideas and past experiences if there is trust and honesty. Contractor Steve Healy of DCH Construction favours an open book approach, enabling true collaboration, whenever possible. Honesty and sharing is also required in the internal culture of firms, he added. "It is important that everyone realises that little mistakes, like nicking a membrane, will be found out in the end, so it's much easier to be open and deal with them right away,"

The question of which form of contract is 'best' came up several times. While some teams have preferences, if there was a consensus, it was that all forms can work well, and all also have the potential to go badly wrong, as both Bill Butcher of Green Building Store, and Jono Hines or Architype pointed out.

Getting it right on paper, and ensuring overlap between design and construction in design and build contracts, is important, according to Andrew Conway of Hamson Barron Smith, which is developing plans for at least 80 passive house dwellings on a 100-unit site at Three Score in Norwich. "We spent a lot of time on the employers' requirements, and we will continue to be involved, to review the contractors' proposals."

John Lefever of Hastoe Housing, which has delivered dozens of passive house units, agreed. "One thing we have learned with design and build contracts is to retain the architect," he said. "It's now one of our requirements."

Lead time between the appointment of the contractors and starting on site was often badly squeezed – yet with some forms of contract it was particularly important to allow time here, as several speakers made clear, because it was only then that the contractor could invest input into the design without risk.

As well as investigating the experience, formal qualifications and commitment to training of potential contractors, face-to-face discussions were the unbeatable way to explore the attitude of the contractor, which can make or break the success of a passive house project. A willingness to learn on all sides was the key to success. "We need to learn from each other," architect Chris Parsons stressed. John Lefever of Hastoe cited this as a reason to go with design and build contracts. "We don't know everything. We hope the contractor will bring their ideas."

Design input from the contractor is important because they are best placed to advise about buildability and point out hidden costs. When tendering, contractor Steve Healy warned the "best price" might not be the cheapest in the end. "If contractors are competing on price, they may do all they can to lower the price on site – meaning you don't get exactly what you have asked for. Prices might also be too low because the contractor simply does not realise what is involved. This would be bad news for the contractor – but also bad news for the client."

With larger passive house projects it is also important to formalise the fine-tuning process post handover, and see the 'soft landings' process as an integral part of the build. Hamson Barron Smith have taken care to include provision for soft landings in their contracts for the Three Score development. Jessica Grove Smith of the Passive House Institute reported on similar process with pioneering passive house hotels in different and challenging climates in China.

Conference chair Chris Herring closed the event by reflecting on the meteoric progress of passive house in the UK. "It is just seven years since the first passive house was certified in the UK. Now we have got to the stage where clients like Exeter City Council feel passive house is 'old hat'."

That is quite an achievement, and despite much disenchantment at the lack of official support from central government, progress shows no sign of slowing down.

Words: Kate de Selincourt

(Above left) Jonathan Hynes (inset) of Architype outlined the journey buildings were taking from poorly insulated low tech buildings to overly-complex attempts at sustainability to low tech, highly energy efficient comfortable buildings; the conference broke out into a parallel expo.

News

It pays to invest in healthy, green offices – WorldGBC

Employers, building owners, designers and developers throughout the world are showing that it pays to invest in greener offices that keep their occupants healthy and happy, a new report from the World Green Building Council (WorldGBC) reveals.

The report, titled 'Building the Business Case: Health, Wellbeing and Productivity in Green Offices' highlights the global momentum behind healthy and green office design and operation, and showcases over 15 buildings that are leading the way.

Simple steps like improving air quality, increasing natural light and introducing greenery can also have a dramatic impact on the bottom line by improving employee productivity and reducing absenteeism, staff turnover and medical costs, according to the report, the latest to be released under WorldGBC's 'Better Places for People' campaign.

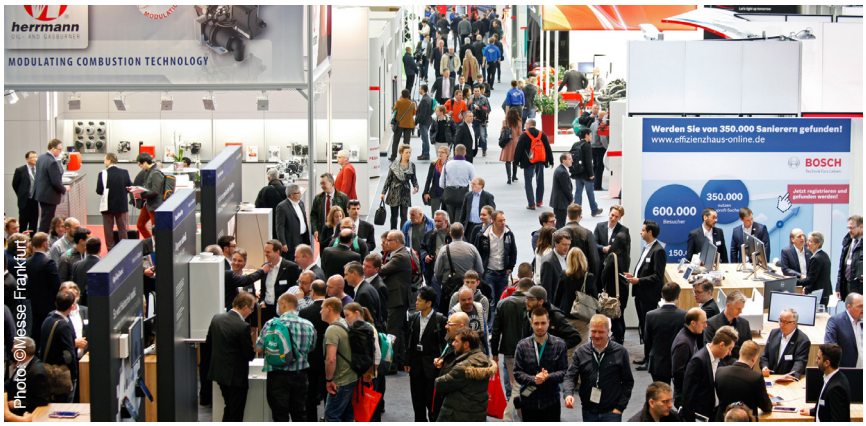
The report identifies eight key factors for creating healthier and greener offices: indoor air quality and ventilation, thermal comfort, daylighting and lighting, noise and acoustics, internal layout and design, biophilia (connection to nature) and views, and the visual look and feel of the workplace.

Speaking to Passive House Plus following the publication of the report, John Alker, campaign and policy director at the UK Green Building Council, said: "There is no question that the topic of health and productivity can help make the national business case for raising standards in the built environment, because it provides an evidence base for policymakers to raise standards, whether through regulations or incentives."

Meanwhile Terri Wills, CEO of the World Green Building Council, said: "This report breaks new ground by demonstrating tangible action businesses are taking to improve their workspaces. The results are clear – putting both health and wellbeing, and the environment, at the heart of buildings, is a no brainer for businesses' employees and the bottom line."

To read the full report and the 15 case studies of individual buildings, go to tinyurl.com/worldgbc.

ISH to bring low energy innovation to Frankfurt in March



ISH, the world's "leading trade fair for the bathroom experience, building services, energy, air-conditioning technology and renewable energies" takes place from 14 to 18 March 2017 in Frankfurt am Main, Germany.

Along with exhibitors' product innovations, the fair will offer a wide and varied programme, encompassing all current developments across these sectors. ISH Energy will include the Technology & Energy Forum, which will be focused on modern, high-efficiency heating technology designed and manufactured in Germany.

The Building Forum, meanwhile, will showcase "innovative solutions for the professional design and realisation of buildings and real estate and for their energy-efficient operation". The Stove Forum will look at current issues in this sector including energy policy, the potential of wood as a heating fuel, as well as recent technical developments and trends.

The ISH Water stand will feature the Bathroom Workshop, organised by VDS in cooperation with Messe Frankfurt, a new attraction aimed particularly at the plumbing, heating and air conditioning trades. The future of bathroom installation and the advantages of pre-fabrication will be presented here in an accessible way, with an emphasis on practical issues. In each case, a complete bathroom of 10 square metres will be built from pre-fabricated installation systems, including cladding with tiles and the installation of surface-mounted products.

The Valuable Water Forum, meanwhile, will be devoted to current themes relating to drinking water hygiene and the safety of heating systems. There will be also be an air conditioning forum, plus a series of competitions and awards across a wide variety of sectors.

Overall, the fair will offer a huge variety of trend shows, competitions, lecture forums, thematic guided tours and new product ranges for trade visitors. Free guided tours will offer an excellent opportunity for visitors to find their way around the products on display and to network with others in their industry. For the first time, there will be thematic tours specifically aimed at visitors in the skilled installation trades.

ISH will take place in Frankfurt am Main from 14 to 18 March 2017. For more information, see www.messefrankfurt.com.

News

UN advocates passive house in latest carbon emissions report

Report author Prof Diana Ürge-Vorsatz praises "fantastic" Dún Laoghaire-Rathdown passive house policy

Words: Lenny Antonelli

The influential Emissions Gap Report, published by the UN Environment Program each year to track the progress of governments on reducing their carbon emissions, has for the first time advocated for the passive house standard in its 2016 edition.

Chapter five of the report, which focuses on energy efficiency, includes a dedicated section on the passive house standard. It reads: "The standard has become popular in several countries, and is experiencing a dynamic market adoption in several regions. The global floor area of Passivhauses has grown from 10 million sqm in 2010 to 46 million sqm in 2016, with the most activity occurring in Europe."

It continues: "Presently, the price premium for new Passivhauses in several countries is comparable to standard construction costs." The report also advocates for net zero energy and energy positive buildings.

Passive House Plus spoke to Prof Diana Ürge-Vorsatz, one of the lead authors of the chapter on energy efficiency, following the publication of the report. "We have a dedicated section on passive house, which is really quite a breakthrough, because usually the report is very short and doesn't go into detail," she said.

Professor Ürge-Vorsatz was also one of two co-ordinating lead authors of the chapter on mitigating emissions from buildings in the Intergovernmental Panel on Climate Change's fifth assessment report, which was published in 2013, and also explicitly advocated for the passive house standard.

She said one reason the IPCC placed such emphasis on the standard is because of the inherent resilience of passive buildings. "Once you have built it, it's low tech," she said. Building to the passive house standard was "not the ultimate goal", she added, but "a very important intermediate goal" on the road to a built environment that produces more energy than it consumes. "The two have to go hand-in-hand — drastic demand reduction, and renewables."

Prof Ürge-Vorsatz explained that while Assessment Report 5 offered many different scenarios under which global warming could be limited to 2C above pre-industrial levels, there would be much more flexibility in terms of the options available for society if energy efficiency was maximised first. "The first goal is try to bring energy demand to as low as possible," she said. "If you don't work hard on your demand, you may have to do everything else."

When Passive House Plus told Prof Ürge-Vorsatz about a comment Passive House Institute director Prof Wolfgang Feist made in these pages a few years ago — that the most ambitious action on climate change was coming from city governments and the European Union, rather than from national governments — she agreed. And like Prof Feist, she suggested this might be because anti-environmental lobbying is strongest at national level.

"Cities are becoming the powerhouse of action, more than national governments," she said, describing the decision by Dún Laoghaire-Rathdown County Council in Dublin to make the passive house standard mandatory for new buildings as "fantastic".

"There have also been a lot of progressive EU policies on climate change and the environment," she added, describing the EU recast energy performance of buildings directive, which is mandating the nearly zero energy standard for all new buildings from 2021, as "extremely forward looking".

But Prof Ürge-Vorsatz criticised retrofit schemes that only grant-aid basic energy upgrades like cavity wall and loft insulation, arguing that these 'shallow' retrofits don't go far enough, and make it less likely that participating buildings will ever receive the deeper upgrades needed to drastically cut their carbon emissions. "I am fully convinced these initiatives are more detrimental than good. You really have to go for deep retrofits."

She stressed that without the deep retrofit of our building stock, society would not be able to reach the 1.5C limit on global warming envisioned in the Paris Agreement without looking at more controversial options, such as major geo-engineering projects.

Prof Ürge-Vorsatz said it was not possible to rely solely on the market to deliver deep retrofits, because as she put it, "nobody invests in 20 year returns, especially when they are small scale." She said that instead, government intervention and clever climate financing were both necessary to stimulate deep retrofit en masse.

Passive House Plus spoke to Prof Ürge-Vorsatz the day after Donald Trump had been elected US president, but despite the result, she was still relatively optimistic about the prospects for global climate action. She said the Paris Agreement on climate change had surpassed her expectation of how ambitious the global community could be in setting goals for tackling global warming.

She praised the climate expert community for embracing a new target of limiting global warming to 1.5C above pre-industrial levels, as envisioned in the Paris text. "As compared to almost any expectation, it was really a miracle what happened in Paris," she said. But she admitted to having deep concerns following the US election result. "Until yesterday morning I was very optimistic, now I'm much more worried.

"We have seen unprecedented, historic and miraculous improvements," she said of global progress on climate change, "but it's very fragile."

(Above left) Prof Diana Ürge-Vorsatz, co-ordinating lead author of the buildings chapter of the UN Intergovernmental Panel Change's 5th assessment report on climate change mitigation, and one of the lead authors on the energy efficiency chapter of the recent UNEP Emissions Gap report.

News

Cygnum Timber Frame picks up five awards in one week


Photo: Darren Carter

Leading timber frame manufacturer Cygnum picked up five awards during one week in October, in recognition of some of the high profile passive-certified projects it has completed in recent years.

The firm picked up four awards at the UK Structural Timber Awards, held in Birmingham on October 19, winning best low energy project and best use of timber frame for the Enterprise Centre at the University of East Anglia, a passive-certified building built with local timber that makes extensive use of natural materials, and has been dubbed the UK's greenest building.

"In terms of a project that would test a timber frame business, this had everything, from sourcing the correct raw materials — primarily Corsican pine from local forests — to huge design and engineering challenges and an ambitious site programme that included insulating and making the building airtight," said John Desmond, managing director of Cygnum. "That said, the project ran extremely smoothly, because the whole team's ethos was a really collaborative one."

Cygnum picked up two 'highly commended' prizes at the Structural Timber Frame Awards — client of the year went to the University of East Anglia for the same project, while Cygnum was also highly commended in the education category for Burry Port Community School, for which the firm constructed a new arts and performance space using the Austrian brettstapel system of glue-free timber construction. The project also made extensive use of local timber.

Both the Enterprise Centre and Burry Port were designed by leading passive architecture firm Architype, with whom Cygnum has collaborated extensively.

"There's a similar mindset in both companies when it comes to sustainability in building, and I suppose a lot of trust and confidence have been built up over a large number of projects," John Desmond said.

Cygnum also picked up the award for best use of timber at this year's Offsite Awards, once again for the Enterprise Centre. The Offsite Awards recognise the best in prefabricated construction and building design.

"For us as a business, these awards are a great recognition for the whole team involved and for the quality of work they do. We have exceptional people here at Cygnum, and it's great for them to hear that from outside of these four walls," John Desmond added.

(Above left) The UEA Enterprise Centre, for which Cygnum won the best low energy project and best use of timber frame awards at the Structural Timber Awards.

Partel launches real-time U-value measurement kit

Passive house & low energy building product specialist Partel has announced that it is now offering real-time, physical U-value measurement with the company's agency for the greenTEG U-value Kit.

The U-value Kit allows direct measurement of the thermal insulation quality of buildings and their elements.The system can be used to measure energy efficiency as well as to design and test new insulation products in accordance with ISO 9869. The system uses heat flux meters (HFM) and temperature sensors to achieve a certified U-value over 72 hours.

Partel's Hugh Whiriskey told Passive House Plus that the system has the potential for use in a number of areas, including academic research, post-completion analysis of buildings to ensure insulation has been installed correctly, building physics analysis, and in the testing of new wall constructions by manufacturers, thus helping to eliminate the performance gap.

The kit is available from Partel throughout Ireland and the UK for sale, rent, or as part of an on-site consultancy service. GreenTEG AG is a Swiss-based manufacturer founded in 2009 as a spin-off of ETH Zurich. Its expertise is in development and manufacturing of highly precise thermoelectric sensors.

(Right) greenTEG U-value Kit, available via Partel.

News

HRV can protect homes from urban air pollution — Solarcrest

While many self-builders and professionals understand the importance of heat recovery ventilation in airtight, super-low energy buildings — such as those built to the passive house standard — the importance of the technology for protecting air in all urban homes from external air pollution is less widely understood.

"Indoor air quality is becoming a hot issue in the UK with reports recently linking 40,000 deaths annually to poor air quality from internal contamination and external pollutants," Eliot Warrington of Cheshire-based retrofit specialist Solarcrest told Passive House Plus.

"Indoor air issues can be exacerbated by external pollution from vehicles and industry. Polluting gasses such as sulphur dioxide and nitrogen dioxide and tiny soot particles from diesel engines have been linked to respiratory problems, lung disease and cancer along with carcinogenic volatile organic compounds such as benzene."

"And the problem is most pronounced in urban areas with London home to some of the most polluted areas in Europe, followed by Leeds and Birmingham, in terms of UK cities that exceed EU safe pollution levels."

Solarcrest have now partnered with surgical air filtration specialists to launch a domestic 'clean room' filter. The company says this super-filter is the only one that stops airborne dust and debris, pollen, microscopic PM2.5 particles, NO_2 and other harmful gases from entering your home and is only available as part of a full MVHR system from Solarcrest.

Warrington said any home or workplace near a busy road is susceptible to these potentially dangerous pollutants — especially in light of the recent discovery that many vehicles are generating far higher levels of pollutants than was previously thought.

"A retrofitted heat recovery ventilation system combats all of the issues by creating a constant, gentle airflow that manages your indoor humidity, keeping it well below the 70% level which sees mould start to grow. By supplying and extracting air, the system also removes household dust and pollutants and cleans the air coming into the home."

(Right) Solarcrest's 'clean room' filter is designed to stop airborne dust and debris, pollen, microscopic PM2.5 particles, NO_2 and other harmful gases from entering your home.

Choose 100% natural wool with no binders or glues — SheepWool Insulation

Wicklow-based company SheepWool Insulation has advised anyone thinking of specifying a natural insulation material that its product is the only sheep wool insulation on the market made from 100% sheep wool, with no synthetic binders used.

"It's the only product on the market that uses 100% pure sheep wool. We do not use any polyester, glues or any other binders," Aisling MacDonald of SheepWool Insulation told Passive House Plus.

MacDonald also told Passive House Plus about the recent use of SheepWool Insulation Premium rolls to insulate the ceiling of a 36 square metre, ultra-low energy house extension in Sandycove, Co Dublin.

"The clients had originally planned to use synthetic insulation, but opted for SheepWool because it is more ecologically friendly," she said. At the house in Sandycove, 150mm of SheepWool Premium was used to insulate the underside of the flat-roof between rafters, helping to deliver an overall U-value of 0.12.

"Generally our Premium rolls are used for walls and sloping areas, however, for this application — installing horizontally from the underside — and because a high performing product was required, Premium was specified," she said. Premium is a high density insulation roll (20kg/m^3) with a thermal conductivity of 0.0359 W/m^2K.

The client at Sandycove commented: "Our extension is really snug and warm, and really retains heat — we can't recommend SheepWool highly enough."

Aisling MacDonald added: "Sheep wool is the only naturally-occurring insulation material which both retains heat inside and protects against external heat, cold and damp. The application process is easy, the material is easy to work with, and our installers always tell us the material is lovely to handle."

"It is the only insulation material whose creator, the sheep, constantly tests it for fitness for purpose in the most extreme climatic conditions." MacDonald explained that SheepWool Insulation can absorb up to 33% of its own weight in moisture without compromising its insulation ability. She also said the material can purify the air in a room by absorbing odours and harmful indoor pollutants such as formaldehyde.

"The SheepWool Insulation range comes with Ionic Protect, an innovative wool protection that is biocide-free, permanent and CUAP-tested." SheepWool is suitable for walls, ceilings and floors throughout all building types.

(Above left) In this recent SheepWool Insulation project, 150mm of SheepWool Premium was used to insulate the underside of the flat-roof between rafters.

News

Manchester house achieves passive cert with Kingspan TEK

A stylish home in South Manchester has achieved passive house certification through careful detailing and the excellent fabric performance of the Kingspan TEK building system employed for the project.

Clients Steve and Mel Howarth hired PHI Architects to create their dream home, and after considerable research, PHI selected the Kingspan TEK building system for the walls and roof of the structure. The firm worked closely with highly experienced Kingspan TEK delivery partners, Point1 Building Systems, to achieve the energy efficient design.

Architect Sara Darwin commented: "Steve and Mel specified a structural insulated panel construction in their initial brief as they were keen to utilise the benefits of off-site fabrication. The Kingspan TEK building system scored highly on thermal efficiency as the core insulation material has a lower thermal conductivity than other products. As such, wall thicknesses could be minimised which was critical given the relatively tight plot."

"Minimising air leakage was also essential as it allowed us to incorporate design elements, such as an L-shaped living space, which added extra external surface area. Point1 Building Systems were responsible for achieving the interface detailing I designed.

They were very confident that we would meet the air leakage requirement as the jointing system and OSB3 facing of the TEK panels inherently support airtight constructions. With the added membranes and tapes they installed, we were able to achieve an outstanding test result of 0.45 air changes per hour at 50 pa."

Kingspan TEK building system panels comprise an OSB3 facing either side of a highly insulated core and can deliver U-values of 0.16 W/m^{2}K or better. Point1 Building Systems worked alongside Kingspan Insulation's technical services to develop a detailed specification which was virtually thermal bridge free.

The panels are factory cut to each project's unique specification, which supports a fast-track erection programme and provides significant design freedom. "The Kingspan TEK building system allowed us to design the first-floor rooms with open 'vaulted' ceilings," Sara Darwin explained. "The tall ceilings create a feeling of space and light and the overall daylight qualities in the house are excellent."

(Above) The Kingspan TEK building system has formed the structure of a new passive house home in South Manchester.

Viessmann install Scotland's first 'heating with ice' system

Premium manufacturer of offsite manufactured eco homes, Stommel Haus, has equipped a private dwelling in Aberdeenshire with groundbreaking 'heating with ice' technology by Viessmann.

The innovative ice store system is installed in the highly energy efficient timber eco-house, a combination that makes the home the first of its kind in Scotland. This heat pump technology recovers heat from renewable sources only, such as the sun, air and ground, and uses it to heat, cool and provide hot water for the building.

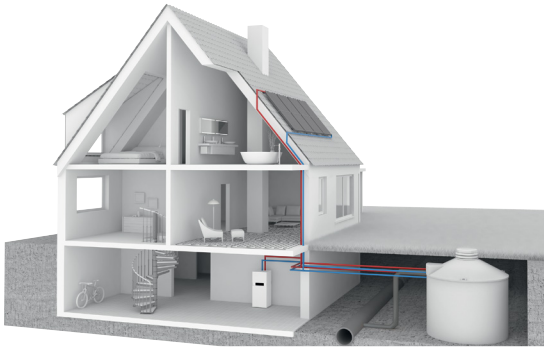
The ice storage system, which consists of an underground water tank, in combination with solar air absorbers, supplies energy to the heat pump that in turn generates hot water for taps and baths as well as underfloor heating on all floors of the house. The system also cools the home in summer months.

The heat pump extracts energy from the water stored in the ice storage tank. The energy used to provide the heat slowly turns the water in the underground tank to ice. Freezing is an exothermic process so as liquid water changes to solid ice, crystallisation energy, known as latent heat, is released. This latent heat is retained in the ice store system and releases additional usable heat, therefore the term "ice store".

A heat source management system integrated in the heat pump draws energy from either the ice store or solar air absorbers on the roof. The ice store also draws energy from the surrounding ground to regenerate heat.

In summer, the ice store can be used to provide natural cooling. At the end of the heating season, the water in the store is turned to ice. The ambient summer heat around the store, the solar thermal energy, and the heat that is drawn from the system via an extraction heat exchanger, melt the ice in the ice store and cool the heating circuit of the house.

Christian Engelke, technical director at Viessmann says: "The standard ice storage tank measures ten cubic metres, which corresponds to the energy content of approximately 120 litres of heating oil. The key difference is that, while the oil is eventually consumed, the water content of the ice store represents an almost limitless heat source that is continuously regenerated with energy from the sun and air."



(Right) An illustration of Viessmann's 'heating with ice' system; the house in Aberdeen which features the system.

News

New Cardiff community centre boasts largest solar array in Wales

The £6m purpose built Star Community Centre, recently opened in Cardiff, is part of the local council's Community Hubs programme, which invests in community services and facilities in priority areas with the aim of making it easier and more convenient for people to access council and partner services. The new building includes a 25m swimming pool, gym and fitness suite, a new library, multi-use training and event rooms, and a community café. Principal contractor Willmott Dixon was tasked to deliver the highest standards of energy efficiency, including solar thermal panels, to reduce heating costs.

Consequently, the rooftop mounted solar thermal system supplied by Kingspan Thermomax is the largest array ever installed in Wales. The 155 sqm solar thermal array is made up of 1,440 Thermomax evacuated tube collectors, horizontally mounted on specially designed low profile frames to reduce visual impact. The collector tubes have been individually rotated to an angle of 18 degrees to face due south to maximise the energy output. The solar system feeds two 1,000 litre Kingspan hot water cylinders, and then automatically diverts to heat the swimming pool.

South Wales-based Ecofit Energy Systems was selected for the installation, and collaborated closely with Kingspan Thermomax to ensure a smooth and trouble-free installation of this challenging solar thermal project.

Steven Birchenough, build manager at Willmott Dixon, comments: "We were extremely satisfied with the level of service that Ecofit and Kingspan delivered on this project. From design through to installation and commissioning, we have been very impressed with the expertise shown. There was some complexity to interface the array with both the building and the swimming pool which we didn't have to manage at all. We certainly hope to work with this project team again soon."

Overall, the integrated solar thermal solution for both domestic hot water supply and pool heating saves up to 30% on energy costs. The carbon savings over the course of the 20-year life of the system would be the equivalent of travelling to the moon and back three times, according to Kingspan. For more information visit www.kingspanthermomax.com.

(Above) The 155 sqm solar thermal array on the Star Community Centre roof features 1,440 Thermomax evacuated tube collectors

Ecological retrofit masterclass hears from housing minister & leading experts

On the 25 and 27 October, Ecological Building Systems in conjunction with their German partners pro clima & Calsitherm, delivered a retrofit insulation masterclass that provided an opportunity for architects, engineers and building professionals from throughout Ireland and the UK to learn about the latest developments in high performance, healthy low energy retrofits.

Proceedings were opened by Irish minister for housing and urban renewal, Damien English. The minister complimented the state-of-the-art training centre, and the positive contribution Ecological has made to the Irish building industry. He went on to state that a core objective of the government's Rebuilding Ireland action plan is to deliver quality, energy efficient housing in a way that meets current needs while delivering sustainable communities and reducing carbon emissions from Ireland's built environment. He emphasised that the delivery of construction skills training programmes in retrofitting are an important contributor to achieving Ireland's climate change targets and delivering quality housing.

Meanwhile Niall Crosson, senior engineer with Ecological, emphasised the importance of properly designed and executed retrofits. He said: "Retrofitting thermal insulation in buildings presents a unique opportunity to significantly reduce heat losses, improve comfort and reduce fuel bills. However, unforeseen consequences such as condensation, mould growth, building damage and a reduction in indoor air quality can occur by using inappropriate materials and poor execution of detailing at the planning and building phase. The aim of our retrofit masterclass is to raise awareness of the implications of poorly planned retrofits and the issues that can arise. The last thing we wish to do is end up retrofitting our retrofits."

Dr Gregor A Scheffler, of Dr Scheffler & Partner GmbH in Dresden, presented the latest guidance in relation to thermally upgrading solid walls and minimising the risk of condensation and mould growth. He highlighted the risks of internally insulating solid walls with inappropriate impervious synthetic thermal insulation, and the increased risks associated with such systems. Dr Scheffler highlighted how capillary active thermal insulation systems such as Calsitherm offer more robust protection against long terms moisture issues and mould, compared to impervious synthetic insulation systems.

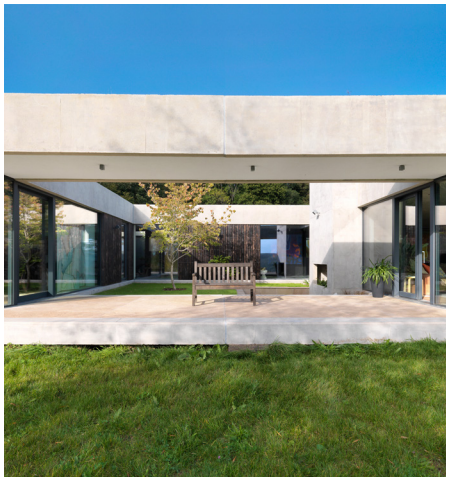
Michael Forester, senior engineer with pro clima, outlined the key steps to attaining a safe flat roof, in terms of condensation risk management. He also presented on how to attain optimum airtightness, thermal continuity and vapour control on pitched roofs with externally applied pro clima membranes such as Solitex Plus.

Meanwhile Roman Szypura of clíoma house presented a case study of a passive house retrofit to a barn in Sligo with Daemstatt cellulose and pro clima Intello Plus on the walls, as well as Gutex Ultratherm on the roof. Ecological plan to hold another Masterclass series based on durable retrofit solutions early in 2017. For more training updates from Ecological, see www.ecologicalbuildingsystems.ie.

(Above left) Dr Gregor A Scheffler speaking at the Ecological Building Systems retrofit masterclass in October.

News

Stunning & airtight Forest of Dean home features vast Internorm glazed wall



A unique new home in the Forest of Dean, designed by Loyn & Co Architects and nominated for this year's RIBA Stirling Prize, features the second largest expanse of Internorm's HS330 large scale glazing system used to date in Europe.

Outhouse is a purpose designed, site specific home for two artists, constructed as a replacement dwelling in a remote location within the Forest of Dean, and with a major emphasis on sustainability and low energy consumption.

Airtightness was one of the biggest challenges on the project, given the complex building form, the variety of wall assemblages and the large expanses of glass. Nonetheless the project achieved a blower door test result of 0.49 air changes per hour for the building envelope, which includes 80 linear metres of the HS330 Internorm timber-aluminium large scale triple-glazing system, including glass corners and in-line glass joins, and has a whole-window U-value of 0.7 W/m^{2}K.

The system was supplied and installed by Internorm's No1 UK partner, Gloucestershire-based Ecohaus Internorm, who also provided the same system for the Caring Wood House in Kent, which has the largest expanse of HS330 in Europe to date, and was designed by Macdonald Wood Architects.

The brief for Outhouse took into account the clients' passion for the landscape and environment, along with their requirement for two artist's studios and a gallery-like space to display their art collection.The response to the brief, and breathtaking site, was to create a single-storey dwelling that is embedded into the hillside.

The layout of the house is organised around a series of external courtyards which trace the footprints of the three buildings formerly on the site, which have been conserved and converted in the new dwelling. The roof is created by continuing the existing upper field along and over the building to create a highly insulated, intensive green roof.

The low lying dwelling is hidden from view from the north, concealed within the existing topography. While the footprint of the 490 square metre dwelling is significantly increased, its visual impact is considerably reduced.

The buried retaining walls are exposed cast insitu concrete with a high percentage of GGBS (a low carbon alternative to conventional cement). Elsewhere steel and highly insulated timber panels form the external walls, along with the 2.5 metre tall Internorm glazing.

The dwelling has an EPC of 96/100 and includes whole house ventilation, a ground source heat pump, solar thermal and photovoltaic panels. U-values for most of the opaque building elements are around 0.09 W/m^{2}K.

Outhouse was nominated for the RIBA Stirling Prize, and won the people's vote for the award, despite not winning the overall prize. The project also won the Sunday Times British Homes Award for one-off houses over 5,000 square feet, and the prestigious Manser Medal.

News

Consider decentralised MVHR for passive retrofits & small dwellings — Sustainable Homes Scotland

Leading low energy ventilation supplier Sustainable Homes Scotland has advised anyone carrying out a deep retrofit — or building a small low energy dwelling — to consider the benefits of a new generation of decentralised mechanical ventilation with heat recovery (MVHR) systems.

"Ventilation is critical for airtight buildings – we all know that. We also have heard from leading lights of indoor air quality research, such as Dr Sterling Howieson, that the risk of black mould increases three times when dwellings are being insulated and made more airtight," said Stefan Huber of Sustainable Homes Scotland.

"The difficult question is, how to implement energy efficient ventilation systems in smaller dwellings and properties that are being upgraded, such as to the Enerphit standard. In such dwellings, whole house MVHR is often quite difficult to fit in, due to the size of the equipment and due to the amount of ductwork."

Huber said that in recent years, a few companies have dedicated themselves to developing decentralised MVHR systems, which work continuously and on higher ventilation levels (up to 100-120 m^3/h), compared to smaller oscillating decentralised units.

Decentralised units are placed into an external wall, such as of a living room. Wet rooms are then connected to this unit via an extract duct system, creating an air flow path through the dwelling. Bedrooms and other habitable rooms tap into the airflow through active transfer units, located within the internal bedroom walls. As stale air is expelled out of these rooms, fresh air is drawn in through door undercuts or other internal air transfer openings.

The ventilation rate is fully demand controlled according to CO_2, humidity and temperature. The active transfer units in the bedrooms are independent, but also fully demand controlled.

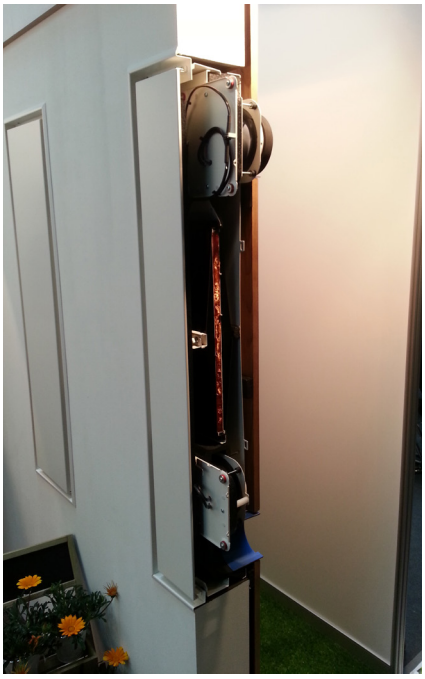
This setup comes with a number of advantages compared to the traditional whole house approach, Huber said. The ventilation adjusts to the use of the dwelling, ensuring that CO_2 and humidity levels do not exceed recommended levels. The system minimises the need for user interference, and also counteracts the risk over-dehumidification, which can sometimes be an issue with conventional MVHR systems.

Such decentralised systems follow the usage cycle between living spaces and bedrooms. Due to their demand controlled operation, they use a fraction of the energy used by a standard MVHR system. The need for ducting is minimal, as only extract ductwork is needed. Advanced control technology allows monitoring of all air quality parameters, if so desired.

"Unfortunately there are some limitations with these systems as well, as each of these units can serve only about 70 square metres of space and one storey at a time," Huber said. "For two-storey buildings, at least two of these MVHR units have to be implemented. There is still a cost advantage for conventional MVHR systems for larger dwellings, until the price for these decentral systems comes down, as they become more widely used."

"Personally I believe that this innovative approach to whole house ventilation will shape the future of the domestic ventilation industry, as it combines the advantages of heat recovery with those of demand controlled extract systems. Some of these MVHR units have now been passive house certified, making them a viable option for passive buildings."

(Below) The inner workings of a dMVHR system from Sustainable Homes Scotland.



Meeting passive standard with cavity walls at Valentine's Day event

Green Building Store is running a training day on 14 February for building professionals, which will offer a practical and technical guide to the cavity wall passive house construction techniques the company has used on its UK projects.

The training day, based at Green Building Store's offices in Huddersfield, will include presentations by the company's technical experts, as well as visits to two cavity wall passive house projects at Golcar and Denby Dale.

Green Building Store built the UK's first cavity wall passive house at Denby Dale, and has pioneered the combination of low energy passive house methodology with standard British cavity wall construction and building materials.

To book a place go to http://tinyurl.com/PassiveCavity.

(Right) Green Building Store's 14 February event will offer the chance to visit the pioneering Denby Dale and Golcar passive houses.

Photos: Iain Richardson/Morgan O'Driscoll

News

Ireland's largest passive scheme achieves world-leading airtightness

The first airtightness test has taken place at phase three of the Silken Park development at Citywest, which is set to be Ireland's largest residential passive house scheme. A diagnostic initial blower door test, done when the external envelope was completed on one of the development's show houses, took place on December 12 and delivered a worldbeating result of 0.16 air changes per hour (ACH), well inside the passive house standard of 0.6 ACH and the best result this magazine has ever noted for a masonry building.

Phase three of the Durkan Residential scheme will feature 59 certified passive houses across a mix of semi-detached and terraced units, with two show homes set to be launched early in February, and the rest of the units set to be complete over the next 18 months.

Phase two of the scheme was profiled in Issue 18 of Passive House Plus, and contained 15 low-energy dwellings all with airtightness of less than 0.8 ACH – including nine below 0.53 ACH, and all featuring demand-controlled ventilation (DCV) systems. All of these units are now sold and occupied.

"The objective for the phase two houses," Jay Stuart, director of the project's building fabric contractor Ecofix previously told Passive House Plus, "was to build better houses by focusing on integrating a designed ventilation system, a high degree of airtightness, minimal thermal bridging and high thermal performance."

"Phase two was really our test bed to see if we could get close to the passive house standard on a commercial scale," Barry Durkan of Durkan Residential told Passive House Plus. Building the third scheme to the passive house standard has only required a few tweaks to the design of phase two — including the selection of MVHR over DCV, an upgrade from double to triple glazing, and a 40mm increase in external insulation to the walls, which are all built from single leaf nine inch hollow blocks. Central to the scheme's success has been the creation of simple, buildable details, a systematic project management approach and on-site training from passive house certifiers The Passive House Academy and airtightness specialists clíoma house.

"It gives us great confidence to really push the boundaries and know that we can achieve passive on a commercial scale," Barry Durkan added.

(Above) Silken Park phase three, as seen on 9 December; (above left) airtightness detailing at a window and joist ends.

Medite SmartPly adopts innovative life cycle assessment technology

Coillte Group's wood panel manufacturing subsidiary, Medite SmartPly, has engaged EcoReview Ireland for the provision of an innovative life cycle assessment application.

The web-based application tool, developed in the Netherlands by EcoChain BV, provides a comprehensive environmental management service, as well as delivering life cycle assessments (LCA) and environmental product declarations (EPD) on all manufactured products.

Speaking on this new development, Medite SmartPly head of innovation David Murray said: "As well as providing us with LCAs and EPDs for our entire MDF and OSB product range, the EcoChain tool allows us to benchmark, monitor and reduce our greenhouse gas emissions as we continually invest and modernise our processes. We can also analyse the environmental impacts of the materials we purchase, so that they too can be substituted by lower impact materials when the opportunities arise. This is very important for Medite SmartPly and our customers as the Paris agreement on climate change comes into force and there are now legally binding limits on global temperature rise."

"In 2013, our parent company Coillte won the prestigious Millicom Award for environmental and corporate sustainability at the European Business Awards, so this exciting new development for Medite SmartPly builds on our market leadership position in sustainable and innovative wood products. With this application we know with confidence that we too are playing our own role in continually improving our environmental performance, and thereby helping our customers and specifiers to do likewise. The EcoChain tool also reports on other environmental factors such as water use, impacts on air quality, and depletion of resources."

EcoReview Ireland manager Peter Seymour added: "We are delighted that Medite SmartPly see the value in the EcoChain application, which already has many hundreds of satisfied users in continental Europe. Medite SmartPly will benefit from the EcoChain tool as a means of improving their environmental performance and providing them with EPDs for all their products."

(Below) Medite SmartPly's innovative Propassiv airtight OSB system, seen here as part of a prefabricated timber frame system.

News

Airflow adds VAV control to its commercial MVHR range

Leading ventilation manufacturer Airflow Developments has added variable air volume (VAV) dampers to its Duplexvent range of commercial mechanical ventilation with heat recovery (MVHR) units. The VAV systems constantly monitor the air volume supplied and share this information with the ventilation unit. As such, the systems ensure optimum air quality and comfort by allowing the ventilation to respond effectively to the demands of each area of the building.

Commercial buildings such as offices, schools, hospitals and retail environments can utilise MVHR technology to protect their building fabric, as well as ensure occupants are benefitting from healthy, fresh air and a comfortable indoor climate. However, with many centralised MVHR systems the ventilation rate remains the same in each room regardless of changes in occupancy levels, temperature or humidity. This means that constant human intervention is needed to deliver the correct air flow at the required system pressure.

VAV dampers offer a solution because they control the flow of air to each zone of the building in response to changes in demand. This helps to maintain a consistently high quality indoor air environment. The VAV dampers fitted to the Duplexvent range constantly monitor the air volume passing through the system and send this information to the centralised ventilation unit.

The communication between each damper and the central unit allows the MVHR system to increase or decrease the flow rate quickly and efficiently based on the demand. When used in conjunction with humidity or CO2 sensors, these dampers can automatically adjust the ventilation rate based on the usage or occupancy of that room, independent of the other areas within the building. Airflow's VAV system also provides the option of manual adjustment for applications where the user requires a level of control.

"Indoor air quality is increasingly being recognised as a key factor for health and wellbeing but the reality is that ventilation requirements can vary significantly across different areas of a building and at different times of the day," said Krzysztof Kwarciak, category product manager at Airflow Developments. "The latest development to our Duplexvent range, the VAV dampers system, ensure our MVHR units can respond swiftly and effectively to these changes in demand."

For more information, visit www.airflow.com or follow @AirflowD on Twitter and Airflow Developments on Facebook.

(Above) A Duplexvent Multi N MVHR system, which now comes with variable air volume dampers

UK's first energy-positive classroom opens its doors

The UK's first energy positive classroom has recently opened at Swansea University. Built by Swansea University's Specific Innovation and Knowledge Centre, the Active Classroom generates, stores and releases its own solar energy.

Electricity for the classroom is generated by a steel roof with integrated solar cells, supplied by Specific spin-out company BIPVco. The 17kWp system includes 145 BIPVco modules which have been bonded directly to the steel roof. Building-integrated solar photovoltaic (BIPV) systems use super thin PV sheets integrated directly onto pre-coated metal and membrane components, to create a combined PV roof system that can be installed in the same way as a conventional roofing system.

BIPVco is a new renewable technology company based in Flintshire, north east Wales, which says it aims to become one of the most innovative and forward thinking manufacturers of second-generation integrated solar technology, more commonly known as BIPV. The company recently won awards for solar technology of the year and clean tech start-up of the year at the Business Green Technology Awards held in London last month.

The roof at the Active Classroom is connected to two Aquion Energy saltwater batteries, which are being used in the UK for the first time, and are capable of storing enough energy to power the building for two days.

The building also uses Tata Steel's perforated steel cladding for generation of solar heat energy, which can be stored in a water-based system, and an electrically-heated floor coating that has been developed by Specific researchers.

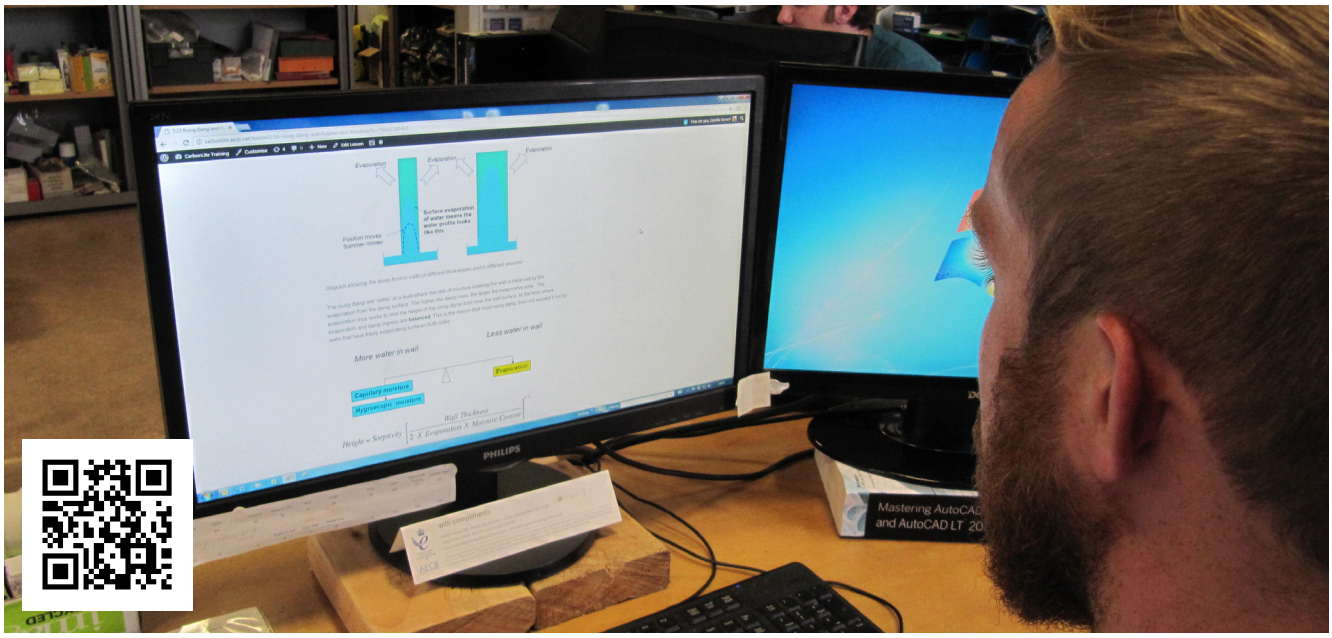
"Some of the technology is new, but most is already available on the market and affordable. Whilst each product is in itself important, the real innovation is in the way they work together to generate, store and release energy," said architect Jo Morgan.

The Active Classroom provides teaching space and a laboratory for Swansea University students, as well as a building-scale development facility for Specific and its industry partners.

Specific is an R&D centre at Swansea University focused on the generation, storage and distribution of solar energy from buildings. It is working with more than 50 partners from academia, industry and government to deliver its vision for buildings as power stations.

News

AECB launches advanced online retrofit training course



If you need to study advanced retrofit but lack the time to attend a traditional training course, then you will be an ideal candidate for a new online solution provided by the Association for Environment Conscious Building (AECB) which allows students to work at their own pace under the guidance of highly experienced tutors. The CarbonLite Retrofit Training Course (CLR) is the culmination of five years of extensive research, and is proving highly popular with experienced architects and designers as well as others carrying out their own retrofit projects. Below, three students outline their learning experience as they come to towards the end of the course.

Margaret, an architect in practice for 33 years, first became acquainted with the AECB when she was searching for a realistic and accurate carbon assessment system for her clients and was introduced to the Passive House Planning Package (PHPP). She says: “After 15 years of working on low energy retrofit and extension projects I am finding the CLR course and PHPP to be brilliant tools to apply to my practice’s future projects.”

“CLR and PHPP are already informing my design work for young couples wishing to enlarge and eco-retrofit properties, to permit and enhance a low-carbon lifestyle in the centre of Cambridge. CLR gives me survey strategies, possible risk identification, ventilation strategies, ways of analysing and ordering expenditure to get a low-carbon result suitable for particular clients’ needs, and ongoing research back-up. PHPP lets me compare a range of solutions, helping get the best cost and carbon values.”

Junko, a certified passive house designer, has worked in the architectural industry for more than 25 years. In the past, she had been concentrating on new low energy projects, but was finding herself dealing with retrofit projects more recently that involved complicated issues such as moisture. Her desire to ensure she could plan and start these projects as effectively as possible was the reason she booked onto CLR.

Studying, while dealing with low energy retrofit projects in parallel, has been a valuable experience for Junko as she has been able to put her learning into practice immediately. She also took advantage of the course’s flexibility, so while she could not attend a couple of webinars, she was able to watch the recordings at a later date. The webinars provide a chance for students to discuss real projects and issues with experienced tutors.

Junko said she found the module on moisture quite challenging but very interesting. This module introduces basic concepts of physics, such as the way that water moves through different materials, and in different phases. Once these are covered the module goes on to consider the more complex realities of heat and moisture physics in real buildings, using real life examples. This is something Junko will be able to re-visit when needed, as the course allows students free access to course materials for a year. After that, students can then pay a nominal fee to keep updated with the course.

Lois and her husband are currently involved in a home DIY project converting an old 1890s Victorian, industrial building into their own home. The property was formerly converted into an office with no emphasis on energy efficiency. The couple are currently mid retrofit with no kitchen and just a wood-burner for heating. Lois describes the course as “superb” and goes on to say: “There is a lot of retrofit advice online but some of it is contradictory. I was eager to obtain reliable information from a trustworthy source to ensure the project is a success, and to have confidence in the approach we are taking.”

The couple intend to live in the house for the next few decades so it is important they get the retrofit right first time. Lois recommends the retrofit course to others who wish to be in control of their own retrofit — provided, she says, they have some background knowledge of science or have a technical mindset.

The CarbonLite Retrofit Course is the latest addition to the AECB’s CarbonLite Programme, which also consists of passive house designer training, AECB Silver Standard building certification and the Low Energy Building Database. The retrofit course develops an understanding of heat and moisture in buildings and issues that can arise from repair, insulation, draught proofing and ventilation. Students learn about ways to avoid or manage unintended consequences, and find out about investment appraisal methods for retrofit. Although the course is aimed at construction professionals, and those whose role involves decision making around retrofit, it is also proving invaluable for homeowners with a desire to drive their own retrofit projects.

The course can be completed in six months with an estimated five hours of study a week or students can take up to a year to complete it, at their own convenience. For more details about the course and to book please go to http://goo.gl/i7aQyJ or scan the QR code. For more information about the AECB and the CarbonLite Programme, visit www.aecb.net.

News

Naked house launches low cost passive for charity & community groups

Naked house, the pre-fabricated passive house construction company, is launching a new ultra-low cost construction option aimed at charitable and community based organisations.

Speaking about the new scheme, Naked house director Ben Nickell said: "We are looking to deliver a limited number of projects at particularly low costs for worthwhile causes. For example, these could be projects run by charities or community interest companies, or they could simply be one-off projects to benefit the local community."

"In general the project's aim should be to benefit a particular community rather than to achieve private profit. Projects which are successful in the selection process will be partly funded by Naked house and will be delivered at a cost well below the going market rates. We are actively seeking appropriate projects to start as soon as possible."

Passive house construction is particularly beneficial to organisations which have limited resources, Nickell said, as the building's ongoing running and maintenance costs will be very low. He explained that Naked house is looking to keep the construction costs low by utilising its ability to optimise a building's design. The correct selection of size, shape, layout, materials, finishes and services can all make a huge difference to the end cost. Meanwhile, keeping the mechanical services and technical construction design in-house keeps the professional fees to a minimum without reducing the choice of available systems. The speed of project turnaround and construction on site is also a huge advantage to organisations with limited manpower to provide for project management.

"The Naked house approach is to look at each project from first principles." Nickell adds. "We are always looking for innovative solutions which reduce complexity and cost. Traditional procurement methods often lead to a high cost of construction for one-off projects. There are few specialist contractors around and the design and commissioning of passive house services is something which is outside the experience of many traditional mechanical and electrical design companies. Using our in-house expertise and practical experience helps to eliminate these costs and we are not tied to any one supplier of components, meaning we can always choose the best solution for each specific building."

"We want to encourage the take-up of the passive house standard by organisations which most need the benefits provided by building to the standard. The organisations that can least afford to construct appropriate buildings are those that most need to keep their ongoing running and maintenance costs down. We're excited to find the first projects for which we can offer this ultra-low cost solution."

Naked house is currently inviting applications for projects to be considered for selection. If you have an appropriate project, please send details to support@nakedhouse.co.uk for consideration.

(Above left) Bardon Mill village hall in Northumberland, a recent low carbon Naked house project.

Swegon launches new range of GOLD air handling units

Swegon has launched a brand new generation of its flagship GOLD air handling units, as the company looks ahead to likely demands for greater energy efficiency, flexibility and comfort in future.

"The most immediate change you notice is the new grey colour of the unit's finish. But naturally, the real innovations are more than 'skin-deep,'" says Dene Kent, sales director and head of ventilation with Swegon.

"Beyond the surface finish, the actual casing design has been modified to increase its airtightness and eliminate cold bridges – all in order to minimise energy losses. Inside the new casing there is a whole new product platform, which enables the unit's modules to be combined far more freely than in previous product generations."

"The product quality, level of performance and streamlining that have hallmarked GOLD over the last two decades has not been compromised. The new platform makes it easier to find the right unit for each individual project, without any customisation required. This means big savings in time and project design effort and results in effective and easily installed solutions."

The flexible platform spells brand new options too. For the GOLD RX units with rotary heat exchangers, there is now the add-on option of a built-in heat pump solution for generating cooling and heating, fully integrated into both the GOLD physical casing and its control system too.

For applications where there's a risk of odour transfer, there is the new GOLD PX, which is based on a unique combination of the efficient RECOflow counter-flow heat exchanger and the intelligent RECOfrost control system.

The first new-generation GOLD units are due to be dispatched from the factory in January 2017.

(Below) The GOLD PX, part of Swegon's new generation of GOLD air handling units.

Building? Upgrading?

Passive House Plus is here to help!

Are you designing, building or pricing a sustainable building? Whether it's an energy upgrade of a small house, or you're looking to achieve high green standards with a new home, office or factory, Passive House Plus can help.

Fill in your details below, or online at www.passivehouseplus.ie & your enquiry will be sent to the Passive House Plus advertisers that provide the products or services you need. If you fill out your postal address we'll even send you the next issue of Passive House Plus free of charge!

PLEASE POST TO TEMPLE MEDIA LTD., PO BOX 9688, BLACKROCK, CO. DUBLIN, IRELAND

name: _____

profession: _____

company: _____

address: _____

_____

phone: _____

email: _____

Site location (please list county): _____

Project type (tick box)

New home ☐ Home renovation/upgrade/extension ☐ New commercial/public building ☐ Upgrade/extension to a commercial/public building ☐

Other (please state): _____

Floor area (approx. ft² or m²): _____

Budget (approximate): _____

Stage (tick box)

Initial appraisal ☐ Pre planning ☐ Planning approved ☐ Pre tender ☐ Commencement notice ☐

Project imperatives (tick box)

Certified passive ☐ Near passive/low energy ☐ Indoor air quality ☐ Low running costs ☐Low environmental impact ☐

Other (please state): _____

Estimated start date (please state): _____

Just tick the products / services you would like more information on:

- Airtightness & draught-proofing products ☐
- Architects & designers ☐
- Building contractors ☐
- Condensing boilers ☐
- Cross laminated timber construction ☐
- Demand controlled ventilation ☐
- Energy upgrade contractors ☐
- External insulation ☐
- Healthy building materials ☐
- Heat pumps ☐
- Heat recovery ventilation ☐
- Heating controls ☐
- Insulation ☐
- Lintels ☐
- Passive house & low energy build systems ☐
- Passive house building contractors ☐
- Passive house consultants & designers ☐
- Project management ☐
- Radiant heating & cooling ☐
- Solar integrated roofing ☐
- Solar photovoltaic ☐
- Solar thermal ☐
- Sustainable mortgages / ethical finance ☐
- Sustainably sourced timber & wood products ☐
- Thermal breaks ☐
- Timber frame ☐
- Windows, doors & roof lights ☐
- Wood fuel / biomass stoves & boilers ☐
- Wood panel products ☐

I would like my project to be considered for feature in Passive House Plus (tick box) ☐

Windows & Doors

UNPARALLELED CHOICE OF PASSIVE CERTIFIED PRODUCTS – OUTWARD OPENING, INWARD OPENING, UPVC, ALUMINIUM, ALUCLAD

GROUND BREAKING U-VALUES **FROM AS LOW AS 0.47W/M²K**

T. 0845 3098007 | E. info@munsterjoinery.co.uk | www.munsterjoinery.co.uk

MUNSTER JOINERY
THE PROFESSIONALS YOU CAN TRUST

No insulation without ventilation!

Neither the retrofit industry — nor its clients — understand the purpose of ventilation, and why a ventilation strategy is crucial for all energy upgrade projects, writes Peter Rickaby.

In the US there is a political maxim: "No taxation without representation". The equivalent for retrofit should be "No insulation without ventilation". Traditionally in the UK and Ireland, we have relied on a benign climate and the leakiness of dwellings to supply fresh air through wind-driven infiltration, and to displace moist, stale air through leakage. Sometimes we have reinforced this process with fans in kitchens and bathrooms but often there is limited provision for a balancing supply of fresh air. So when we insulate a dwelling (in any way), replace the windows and improve airtightness, infiltration and air leakage levels are reduced, moisture and carbon dioxide concentrations rise and the consequences are poor indoor air quality (IAQ), condensation and mould. That's why we must improve ventilation whenever we insulate.

However, evaluation of the UK's Retrofit for the Future projects demonstrated poor understanding of ventilation. Neither the retrofit industry nor its clients understand the purpose of ventilation, why a ventilation strategy is important, how to design, specify, install and commission ventilation, or how to explain the importance of ventilation to occupants. There is inadequate knowledge of simple ventilation, let alone techniques such as demand controlled ventilation (DCV), even though such systems are common in Europe.

There are many good ventilation products, but some suppliers lose interest when their products leave the factory gates. When IAQ problems occur, contractors, installers, landlords and occupants often blame each other. It is usually during design, installation or handover that things go wrong, because there are few properly trained designers or installers of domestic ventilation systems.

Another maxim, also learned from Retrofit for the Future, is "Don't default to MVHR". Almost all design teams in that programme, and many retrofit teams since, specified mechanical ventilation with heat recovery (MVHR) because of their background in passive house. But passive house is a standard for energy efficient new dwellings in which MVHR has three roles: providing good IAQ; recovering the ventilation loss (to meet the challenging energy standard); and distributing the very small required heat input around the dwelling. MVHR works well in new passive houses, where the envelope is airtight, where the heat exchanger and the ductwork are within the insulated envelope, where ducts can be large, round, smooth and straight, with no branches and minimum bends, and where filters are readily accessible. In existing Victorian terraced houses, 1930s semi-detached houses and 1960s flats these requirements can rarely be met. It is not just that the envelope can be very challenging to make sufficiently airtight for MVHR to work properly. MVHR doesn't easily fit, and the compromises to make it fit – cramming heat exchangers into cupboards, convoluted arrangements of flexible ductwork, routing ductwork through unheated lofts – all increase resistance, fan-power and noise, and reduce efficiency. Hence the rise of decentralised units and approaches to house building services in prefabricated external insulation panels. Fuel-poor occupants, who perceive ventilation as noisy, draughty and expensive, often turn the systems off, though this may be reflective of a more intractable problem – the evidence shows that even holes in walls and trickle vents are routinely blocked, with the isolator switches on intermittent extract fans turned off.

For retrofit projects the passive house and Enerphit standards are often too challenging. If we can reduce average emissions by approximately 60% we will be doing well, and the supply side (decarbonisation of the electricity grid, etc.) will contribute the other 20% needed to meet our national emissions targets. In that context, heat recovery is an unnecessary luxury, and dispensing with it makes life simpler – half as many ducts for a start! We should not be defaulting to MVHR, but considering all the options and finding the best system for each project.

Continuous mechanical extract ventilation (MEV) is often a good option: it can be centralised (cMEV) with ductwork and a single fan or decentralised (dMEV) with several fans – though the very poor findings on dMEV from the as yet unpublished Aecom study for the Department of the Communities reported by Kate de Selincourt in issue 18 of Passive House Plus are real cause for concern. Adding demand control via relative humidity (RH) sensors or RH sensitive air inlets combined with constant pressure fans reduces over-ventilation, ensures that ventilation is provided only where and when required, and improves energy efficiency to a level competitive with MVHR.

We are making progress. At Thamesmead, Peabody is working to eliminate condensation, damp and mould (CDM) and mitigate fuel poverty. Their excellent CDM strategy is essentially a ventilation programme, combined with improved heating controls and energy advice, but finding affordable ventilation systems that are quiet, effective and fit into 1970s flats is proving a challenge. The Retrofit Academy, whose acclaimed eight-day Retrofit Coordination and Risk Management training programme includes a whole day on airtightness and ventilation, is seeking to upskill the industry on a broader front. The BSI Retrofit Standards Task Group has adopted the "No insulation without ventilation" maxim and introduced requirements for ventilation upgrades into the consultation draft of PAS 2030: 2017. But there is still a long way to go.

Peter Rickaby is Director of Rickaby Thompson Associates Ltd Energy + Sustainability Consultants, a member of the Board of Trustees of the National Energy Foundation, chairs the BSI Retrofit Standards Task Group and is a member of the Implementation Board of the Each Home Counts (Bonfield) review.

Passivhaus by Kingspan

The new Kingspan Passivhaus has been designed by HTA Design LLP in collaboration with Potton.

The idea behind the design of the housetype was to defy the stereotype that Passivhaus will not work with generous openings and a form that deviates from the typical boxy design with small windows.

Visit **www.kingspaninsulation.co.uk/passivhaus**

Kingspan®

Further information on the Kingspan range is available on:

+44 (0) 1544 387 384

literature@kingspaninsulation.co.uk

www.kingspaninsulation.co.uk

Pembridge, Leominster, Herefordshire HR6 9LA, UK

Our passive journey:

Planning, storm water decisions & heating with tea lights

In the fourth instalment of Nessa Duggan's column on designing and building a passive house for her young family, the focus shifts to overcoming drainage issues to secure planning, and just how small the heat load may be in the family's new home.

As winter sets in again in our cosy semi-d, drafts from the trickle vents battle to keep condensation at bay and the low sun highlights the dust. This is motivation to pick up the pace on our new build in the hope that next winter for us will be draft and dust free. Several weeks after the planning application went in, a request for further information on six details came through. Contrary to the bad press often associated with the planning process, all were reasonable and in line with the conditions stated in the outline planning permission. Thankfully no cause for concern, just another delay.

Adequate management of storm water was the most complicated detail for clarification. Management of run-off within the site was a condition of the outline planning permission. As is becoming a habit, we researched storm water management in some detail. Due to the house being part single storey with an integrated garage and car port, at 300 sqm the roof is quite large in proportion to the overall floor area. The scale of the potential run-off surprised us, requiring several attenuation units with a combined capacity of at least 15m^3 to comply with planning.

From a sustainability point of view, it seemed obvious to explore rainwater harvesting as an alternative to just managing the run-off. At an estimated consumption of 198L/day for 5 people, on balance, a 5,000L tank was recommended. This would contribute approximately a third of the necessary capacity, and additional attenuation measures would also be required. At an estimated cost of €5,000 for a standard, below ground rainwater harvesting system, we figured it was early in the process to unnecessarily commit. In the end, we submitted a proposal for storm water management that did not include rainwater harvesting, but no doubt we will install a butt for water use in the garden.

This research highlighted that, due to the valley in the roof above the front door and the rear patio door, management of drainage from the largest section of the roof would not be straightforward. Better to consider options at this stage and carefully plan a solution. The original wish list included no drainpipes on the front façade of the house. One option might be to drain the roof through a downpipe internally within the house and out through the floor. Another option under consideration is a rain chain – a Japanese style alternative to a downpipe with the potential to turn a concern into an opportunity to create a decorative feature. This is the first brush we've had with thinking about nice features we may include as opposed to being entirely concerned with the engineering of the house.

> "Another option under consideration is a rain chain – a Japanese style alternative to a downpipe with the potential to turn a concern into an opportunity to create a decorative feature."

Full planning permission was granted four months after the original submission and almost two years after closing the sale on the site. As a contemporary house on a road lined with traditional houses, the planning process was relatively painless. Not wanting to put the cart before the horse, without full planning permission we didn't move ahead with other aspects of planning the build. However, much like the balance of water, we started to think about the balance of heat.

To comply with the passive house standard, the specific heat demand target is ≤15kWh/m^2 annually. In comparison, our current annual usage of gas is approximately 68 kWh/m^2. That's at least 4.5 times more energy than our new home will need to achieve a far superior level of comfort. I'm looking forward to successfully growing basil all year around with a consistent 20C indoor climate.

Being less sceptical than most of the performance of the passive house standard, talk of installing backup traditional heating systems urged me to understand the source of this heat, albeit small. According to a 2008 SEAI report on passive house design in Ireland, the heat requirement in a passive house comes from three sources. Passive solar gain (40-60%), internal heat gains (20-30%) and the remaining 10-40% from an auxiliary heating system. An iPHA publication I found states that 10 tea lights, or even the body heat of four people, could keep a 20 sqm room in a passive house warm in the middle of winter in the coldest of climates.

Another interesting nugget I came across is that Ireland is in the same category as Germany for climate (both considered mild), as temperatures in Germany are a lot more extreme than Ireland. So if the fabric of the house is specified correctly and the quality of construction is up to the standard, there's no cause for concern or a traditional backup heating system, even in Ireland!

We have come to accept that we are more interested in being involved with the technical detail of the project than most self-builders and this is going to make every stage slower. With no pressure to leave our current home, there is no target date for completion. Although from this point forward we will be more careful about agreeing completion dates up front with anybody we engage with. The focus now is on hiring the best professionals to help us make informed decisions at each stage. Our hope is that meticulous planning will make for a more efficient build phase, fingers crossed!

SMARTPLY®
PROPASSIV

AN AIR TIGHT OSB SYSTEM YOU CAN DEPEND ON, ALL WRAPPED UP IN
ONE PERFECT PACKAGE

SMARTPLY PROPASSIV is a fully certified, zero added formaldehyde, structural, air and vapour tight OSB panel system for the construction of Passivhaus and Low Energy buildings.

To find out more or request a product sample, call **01322 424900** or visit **MDFOSB.com**

SMARTPLY®
DEFINING THE STANDARD OF OSB

A new route to quantifying a building's greenness

Accurately pinning down a building's energy performance may be vexing, but it pales in comparison to a building's material impacts. But a major breakthrough may be on the cards, as Irish Green Building Council director Pat Barry reveals.

When the IGBC started to develop the recently launched Home Performance Index – Ireland's 1st sustainability assessment system for quality new residential development – we were faced with the challenge of how to assess construction products. We quickly realised that the only state-of-the-art way to do this is through full building life cycle assessment (LCA) – ideally to the European standard for construction works, EN 15978. But applying this to housing seemed impossibly complex and the infrastructure, data, software, and professional skills still did not exist. We needed to establish this infrastructure ourselves.

> "There's no point specifying a low carbon product if the design isn't optimised to reduce the materials needed."

We set out a business plan of how this could be achieved over the coming years. First we needed to establish an Irish environmental product declaration (EPD) programme – the first step in mainstreaming LCA of buildings. LCA requires calculating out the total impacts of the building across its entire life cycle including the environmental impacts of the products used to build, maintain and operate the building.

As we move towards nearly zero energy building embodied impacts represent nearly 50% of the overall impact of the building over its lifecycle – and for certain building types such as industrial or warehouses, well over 50%.

LCA in Ireland is currently where energy assessment was 20 years ago – non-existent. We have to move away from simplistic approaches to materials where we talk about sustainable materials or recycled content, towards an approach where we look at sustainable use of more sustainable materials.

In LCA of buildings, the construction products, their quantity, their function and their performance throughout the building's lifetime are fully integrated. This means full integration of architectural design, structural design, maintenance considerations and energy performance to optimise the operational and embodied impacts across the lifetime of the building.

There's no point specifying a low carbon product if the design isn't optimised to reduce the materials needed, as unsustainable use means the reduced impact of the material is cancelled out. At its simplest, optimisation of design means not building more house than you actually need. After this you can look at the form, optimising the structural spacing of columns, beams and structure to meet the functional needs. This then should drive innovation in structural design and indeed reduced cost. A lot of carbon reduction is possible even with standard materials. For example concrete strength mixes can be modified for specific structural function.

Embodied carbon has been a buzz word for years but in reality very few are currently measuring it. We have looked enviously at countries like the Netherlands where LCA is now hardwired into building permits with simple calculators which draw on extensive databases.

However in order to calculate, you need the data. EPD provide this verified data. Countries such as Germany, Norway, France and the Netherlands are well on the way. Other countries are still just trying to build up the databases to allow calculation and benchmarking to happen further down the road. The use of EPD is rewarded in all the international sustainability systems used here such as LEED and BREEAM, and is expected to be used in Ireland's forthcoming green public procurement manual developed by the Office of Public Works. We knowof commercial architectural practices who in order to maximise the points available in LEED, provide the contractor with a list of products that have EPD – meaning a real competitive disadvantage for any supplier who can't produce one.

Irish manufacturers are beginning to develop EPD but have to date relied on international programmes to publish them, meaning there is very little awareness amongst Irish specifiers. We spoke to agents of products in Ireland where the international supplier did have EPD but they were not aware of them because they had never been asked for them. The development of a national database will give a much higher profile to EPD and encourage much greater uptake. In fact Enterprise Ireland were offering a 50% grant to Irish manufacturers some years ago to develop EPD so that they could compete in international markets.

It is hoped the EPD database will shortly link to a national environmental database containing generic data where product-specific data is missing.This can then be used to populate calculators or BIM to calculate a building's LCA – likely as a value per square meter, or for homes as a value per occupant. Building typology benchmarks can be set once there is enough comparative information available. This should drive more sensible use of materials, eliminating the often senseless waste due to lack of design integration between structural engineers and architects. The mindset where we keep pouring rather than design needs to change.

The IGBC will establish the national methodology for preparing an EPD in line with EN15804 so that these are recognised across Europe, allowing suppliers and manufacturers to upload their 3rd party-verified EPD on our national platform, an initiative part funded by the EPA Green Enterprise scheme. Our Finnish Green Building Council Colleagues were involved recently in the establishment of the Finnish EPD database, and informed us that this had an immediate impact of driving manufacturers to develop EPD.

Our next step is to crack on and make the data usable for time-pressed practitioners. Our goal is within 24 months to have a BIM-accessible database of generic and product-specific data, plus an easy-to-use, low-cost or free calculation tool for the market, and a critical mass of trained professionals.

We recently delivered training to the first set of construction professionals using the Finnish developed LCA software, One click LCA. This software turns what used to be two to four work weeks of drudgery and trawling through different disperse data sets and individual EPD into a two minute exercise…that is if you have a well-developed BIM model. At worst with a cleaned up bill of quantities the workload is reduced to a day. This is a major advance.

With revisions to BREEAM and LEED V4 LCA is about to take off, but it needs to be accessible to the ordinary practitioner – not just the major consultancies.

To find out more about EPD and measurement of LCA for both manufacturers and specifiers, and the IGBC's EPD programme please visit www.igbc.ie

WE RECYCLE HEAT

The more heat we recover, the less you need to generate

Our heat recovery ventilation units recycle up to 92% of the heat within a home, which is then used to warm the incoming fresh air. We recover even more heat with our heat pump ventilation systems. PassivHaus certified.

Simple, sustainable, effective, healthy.

total home environment

We do more with air...

SAP Appendix Q · PASSIV HAUS INSTITUT · NACSBA · Genvex

0345 260 0123 · www.totalhome.co.uk

mvhr

/'the-*ultimate*-ventilation-system'/

definition

One air change every two hours with less than 10% heat lost; dust, pollen, diesel PM2.5 & NO2 filtration; auto summer bypass with cooling facility for summer; auto frost protection to -20C with 2.5kW room heater for winter; ultra-quiet, easy to fit ducting with silent night time operation; ultra-low running cost with extra long-life brushless motors; customer service, bespoke (free) system design, new build & retrofit install rated 'Excellent' by home owners, developers & architects alike; 5-year mechanical warranty & 10-year insurance-backed installer guarantee; complete peace of mind.

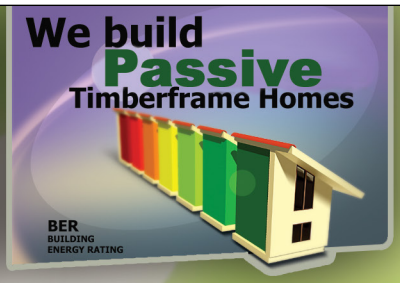
"awesome, amazing, couldn't be without it"

That's our definition. What's yours?

Tell us: 01625 423020
www.solarcrest.co.uk/mvhr

Solarcrest
COMPLETE ECO-RETROFIT

MBC
TIMBER FRAME



MBC Timber Frame is a long established company that specialise in the production of super insulated, precision engineered, energy efficient passive homes throughout the UK. We are a registered member of the Structural Timber Association and are quality accredited with an outstanding reputation for:

- Highest quality construction standards and methods.
- Environmental compliance through the use of Eco-Friendly materials.
- Customer service, reliability, affordability and competitiveness in the market place.
- Craftsmanship and rigorous attention to detail

At MBC our experience and continuous focus on quality enables our team to satisfy the specific needs and requirements of each individual project, while at the same time provide outstanding service and support to our clients.

SUPERB ENERGY EFFICIENT PASSIVE HOMES - REDUCED ENERGY COSTS

UK Office: Quedgeley Court, Sheperd Rd, Gloucester, GL2 5EL
Tel: 01452 346499 | info@mbctimberframe.co.uk

STRUCTURAL TIMBER ASSOCIATION Accredited Member · NaSBA · FSC

Quality without Compromise

www.mbctimberframe.co.uk

Photo: Flynn HRV

New build homes
face emerging ventilation crisis

Despite increasing standards of insulation and airtightness, housing developers face few requirements to provide better ventilation and indoor air quality for new home buyers — beyond knocking extra holes in walls. But as reports of condensation and mould affecting new housing developments continue to surface in both the UK and Ireland, and research indicates many new homes may have poor indoor air quality, are developers finally waking up to the need for properly engineered ventilation systems?

Words: John Hearne

Despite the fact that we've seen some very significant enhancements in the energy performance of new homes on both sides of the Irish Sea, there is one element of residential construction that has proven almost totally resistant to improvement: ventilation.

We may have made our homes more airtight, beefed up the insulation and installed much better windows, but the quality of air in these homes might be – if anything – getting worse.

Changes to Irish building regulations introduced in December 2011 mean that all new homes are designed to use 60% less energy than homes built to 2005 standards, which on average translates to a mid A3 building energy rating. So far so good.

But research carried out by this magazine has revealed that 63% of these homes are reliant on so-called 'natural' or 'background' ventilation. This means nothing more than drilling a hole in the wall and slapping a grille over it. Despite the fact that there is little evidence that this is an adequate solution, it's entirely permitted by regulations. And because it's the most cost-effective recourse out there – if your sole concern is meeting the requirements in the government's guidance on ventilation – it is the default choice of most developers.

Meanwhile, at an event organised by the Green Register in June, Aecom and The Zero Carbon Hub presented findings from an as yet unpublished report on the ventilation installation and performance of almost 90 UK new builds. They uncovered a startling range of problems, including poor air quality, a lack of commissioning of systems, and insufficient flow rates in fans. Only three of the homes surveyed were actually compliant with Part F of the building regs (the section that deals with ventilation).

It's hard to find a definitive reason why ventilation has become the poor relation in the houses that we build. Given the choice, none of us would opt to live in a house where the air did not circulate, or was clogged with pollutants. And yet we do.

Andrew Lundberg of Passivate is a passive house consultant well placed to comment on the emerging ventilation crisis. He makes the point that central to the problem is the fact that many of our new houses are becoming more airtight almost by accident. Even when there is no conscious effort to focus on airtightness – as would be the case with a passive build – a combination of factors is making better airtightness a default choice.

"I'm talking simply about the use of new materials that have come onto the market in recent years, and the most common ways of building now," he says. "Wet renders inside buildings, taping windows, and the use of a membrane across a roof...Without taking care of the finer detail of how those things come together, these alone can bring us down to typically two or three permeability in many cases."

Permeability measures unintended air leakage through a house. Irish building regs stipulate that new dwellings should achieve a pressure test result of no worse than an air permeability of seven (measured in metres cubed per hour per metre squared, at a pressure of 50 Pascals — or $m^3/hr/m^2$ at 50Pa). The 'two or three permeability' that Andrew Lundberg routinely encounters is much better than the

unambitious regulatory threshold, and it may actually be standard practice: Passive House Plus analysis of SEAI data indicates that the average airtightness test result of new homes built to the latest version of Part L is 3.7m^3/hr/m^2.

To state the obvious, the more airtight the home, the more important ventilation becomes, and the regulations do acknowledge this. Part F stipulates that if a naturally ventilated building reaches an airtightness level of five cubic metres of air leakage per hour for each square metre of envelope area during such a test, the developer must increase background ventilation by 40% of clear area. That is, he must drill 40% more holes in the walls, or increase the core diameter of the holes by that proportion.

Andrew Lundberg says: "I had a project recently where the builder had built well below five air changes per hour (ACH), but wasn't aware of the implications, and nor was anyone else involved. They realised there was a problem when they started to get mould in the houses."

"Now, these houses had been very well built, there was no issue around continuity of insulation around junctions, or anything like that. It was simply that the humidity wasn't being dealt with because the building was so airtight and well insulated."

As the onsite consultant, Lundberg proposed a demand controlled mechanical ventilation solution, which worked out at just under €900 per dwelling. But this was not the cheapest solution. The cheapest solution was to drill 40% more holes in the wall. That's what happened, and sure enough, the mould went away.

The problem with this 'solution' however, is that these holes are so big and there are so many of them, that they will almost certainly lead to draught issues during the winter. And when the occupants move in, at least some of them will block up the vents. The draughts will go away, but back will come the mould.

The situation is more or less identical in the UK. In naturally ventilated dwellings, once the air permeability drops below an air permeability of five, background ventilation provision has to be increased. One increasingly common alternative however is to install a decentralised mechanical extract ventilation system (dMEV). A decentralised system is essentially individual fans installed in wet rooms (in the same way as intermittent fans) that operate continuously, and may boost either manually or automatically during periods of higher humidity. With this strategy, you are allowed to build as airtight as you like.

Ian Mawditt runs independent building performance company Four Walls. He explains that one of the advantages of centralised ventilation systems is that fans are located in an enclosure (often acoustically-treated) and are tucked away in voids or lofts, to prevent noise becoming a nuisance.

"But if you put the fan on the room side [as with dMEV], even if it's running at a lower rate than an intermittent fan, it's still going to create a constant background noise. In most homes I've visited, noise has been a major issue for residents, and this frequently leads to systems being switched off."

Photo: fourwalls

"If constantly operating fans are turned off, whether centralised or decentralised, there is a significant risk of under-ventilation, which in turn will lead to poor air quality. This is because it is only required to put smaller ventilators [compared to natural ventilation openings] in bedrooms and living rooms to act as air inlets. If the fans are turned off then there will not be a negative pressure inside the home to provide sufficient ventilation. With dMEV there is a greater risk of systems being switched off, and without a negative pressure induced by a fan, the ventilators will be too small for sufficient natural ventilation."

The second way of dealing with the 'accidental' airtightness issue is no less retrograde. Some developers who find themselves inadvertently below the threshold, will simply cut a hole somewhere in a membrane. They deliberately wreck the energy performance of the house simply to avoid the necessity of drilling more holes.

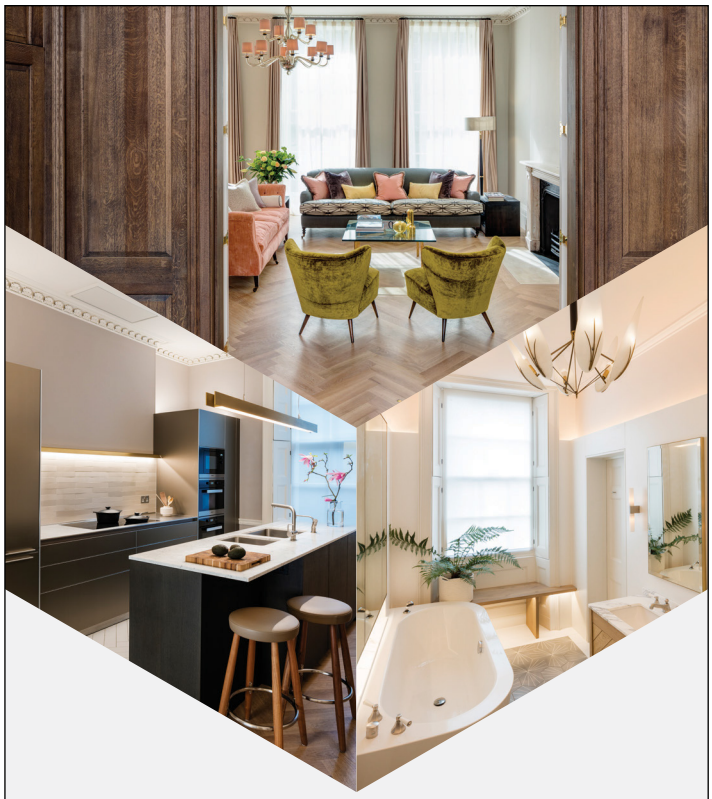
Andrew Lundberg points out that this approach can create even more problems. Stabbing the membrane at some arbitrary point means that when atmospheric conditions prompt air movement, an excessive amount of the humidity in the space will exit through a single tear.

"All of a sudden," says Lundberg, "you've got a massive focus of moisture in the form of vapour at a small number of locations in the building. It could, for example, be a roof membrane that takes the cut, and if you cut a roof membrane, you're never far from a piece of timber, so you could be introducing a local condensation risk, which could lead to mould growth on local surfaces at the location and longer term damage to the building fabric."

It's the invisibility of this risk that makes it so insidious. If a radiator doesn't work, you will know instantly. But if the ventilation strategy does not deliver good air quality, and has

Photo: www.mouldsolutions.ie

(top to bottom) A detail described by ventilation consultant Ian Mawditt as fairly common: the bathroom extract and supply are so close that recirculation of stale, moist air – and odours – are inevitable; mould diagnosed as caused by lack of air circulation; hole-in-wall vents are often blocked due to the discomfort caused by uncontrolled ventilation.



London's Proven Passivhaus builders

Exquisite builds completed in Kensington, Bloomsbury, Belsize Park & Maida Vale

Green Building Store preferred MVHR installer for London

BOW TIE
CONSTRUCTION

bowtieconstruction.co.uk

Healthy insulation can naturally do more.

Sheep wool: a natural insulator.

100% Pure Wool with
IONIC PROTECT.
the new, innovative wool protection

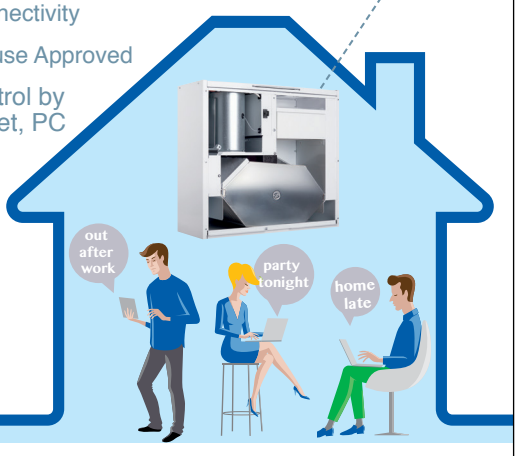
SheepWool®
INSULATION

Call now on 01793 847 444 or email info@ecomerchant.co.uk

Adroit™

Smart Ventilation with Heat Recovery
Take Control, at Home or "On the Go"

- Nine models from a flat to a mansion
- Over 90% heat recovery
- Fresh, triple filtered air
- Low energy EC fans
- Internet connectivity
- Passive House Approved
- 'Smart' control by phone, tablet, PC
- 100% summer bypass



CERTIFIED COMPONENT
Passive House Institute

Call: 01494 560 800 Visit: airflow.com

AIRFLOW®

instead introduced condensation into the building structure, you may not know about it until it's too late.

Even assuming you accept the 40% more holes and put up with the winter drafts, hole-in-the-wall systems won't keep the air fresh because they are systemically flawed. They rely on variations in pressure and temperature to move air from the inside to the outside. Relative differences in humidity, CO_2 and other pollutants will not prompt the required movement in the air; these contaminants will just sit there, no matter how big the hole in the wall, until such time as temperature and/or pressure variations change conditions.

Andy Lundberg puts it like this: "The parameters that dictate how much fresh air we need are not the parameters that affect how air moves naturally based on current part F." By contrast, demand controlled and heat recovery ventilation (HRV) systems have sensors which will adjust fan speeds based on CO_2 and humidity levels.

Maurice Flynn of Flynn Heat Recovery Systems says he gets at least ten calls every year from people with houses two or three years old – all built to high standards – with mould and condensation issues.

"Some people deal with condensation and mould by opening windows every morning and routinely cleaning mould from affected areas. The ones that contact us are looking for a long term solution. We are only one small HRV supplier in Ireland, installing only a few hundred per year. How many other guys are out there doing HRV? I'm sure the enquiry rate for all providers is huge, and these are new houses with serious problems."

Like Andy Lundberg, Flynn has been well placed to observe developer antipathy to demand controlled and heat recovery ventilation systems. He points out that that antipathy isn't all about cost. The fact that there is no regulatory body to administer or police the installation and commissioning of ventilation systems means that when things go wrong, it's on the systems themselves that prejudice tends to settle.

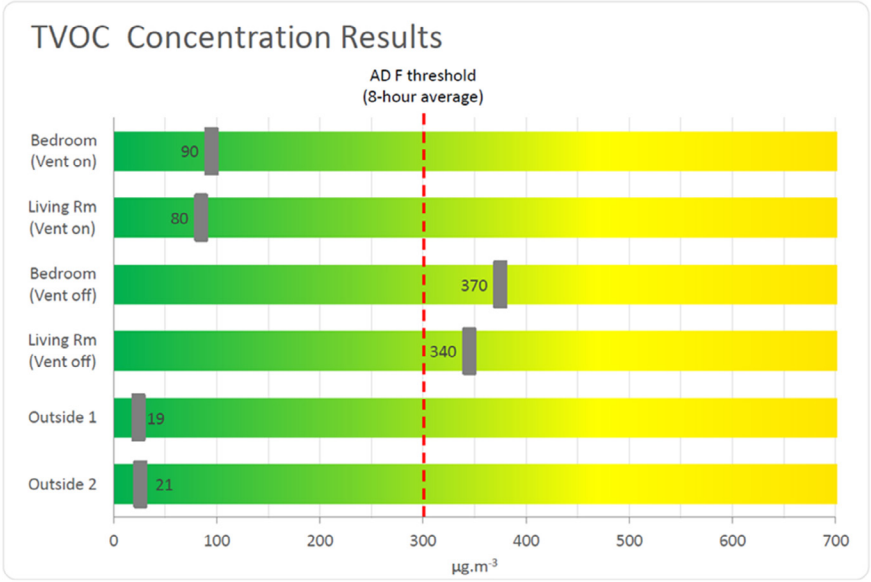
In the absence of an independently accredited ventilation professional, it generally falls to the plumber to source and install mechanical systems.

"We have invested heavily in equipment like anemometers, sound meters and air quality monitors," says Flynn. "A good quality commissioning anemometer costs at least a couple of grand... It is very difficult to expect any contractor who is not installing these systems on a daily basis to a professional standard to invest in this equipment. That's a sticking point, and so is this: no one checks the work that installers do, there's no one to say that this or that system meets the required standard."

It would be wrong however to suggest that nobody's doing it right. When phase one of the Silken Park development in City West, Dublin was completed in 2007, the 22 apartments

(top to bottom) mould at the junction between an external wall and a vaulted ceiling in a naturally ventilated low energy extension; total volatile organic compound readings from Ian Mawditt's deep retrofit in Bristol reveal a significant increase in VOCs when the MVHR system is switched off – which may hint at how a low energy home with natural ventilation would perform with vents closed; radon readings from Ian Mawditt's house with MVHR system switched on and off reveal that lack of ventilation would cause the cancer-causing gas to accumulate above safe levels.

Photo: Simon McGuinness



and 33 houses were built to 2002 regs, and featured partial fill cavity walls and standard hole-in-the-wall ventilation, with no provision for airtightness. Phase two, which was recently completed, includes 26 houses and three apartments. Each boasts highly insulated, single leaf walls, passive standard airtightness and demand controlled ventilation.

And phase three – on which work progressed this autumn – will showcase 59 certified passive houses, each of which will feature mechanical heat recovery ventilation.

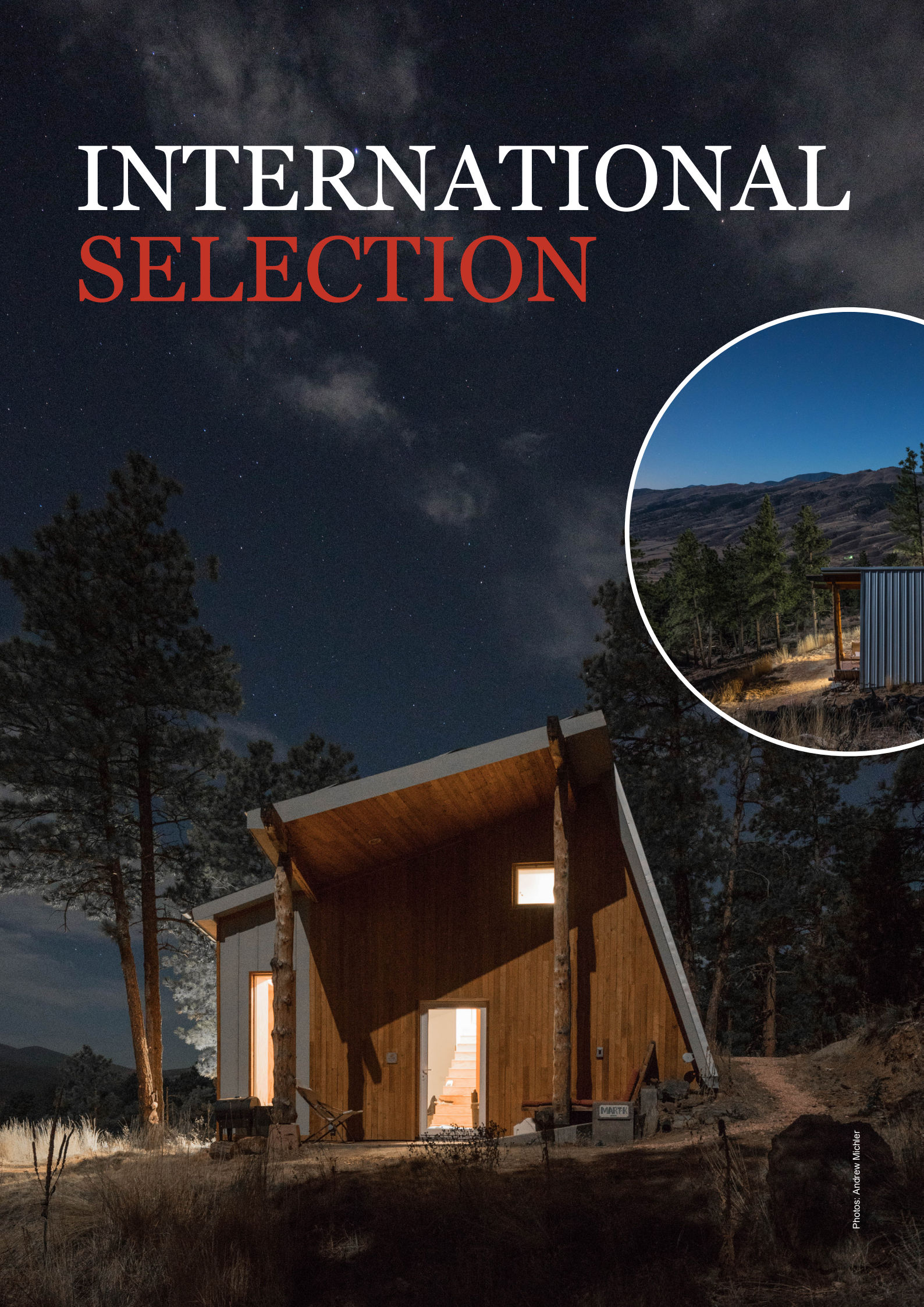
The company behind the scheme, Durkan Residential, is run by brothers Patrick and Barry Durkan. Patrick Durkan explains that the company's evolution to the point where they are about to embark on the mass production of passive houses came primarily through a focus on quality.

"Our main concern, our main focus," says Durkan, "is to achieve a great product. To do that, obviously, you need airtightness. But to counteract that, you have to have ventilation. If you don't go the ventilation route, it's all in vain."

Large scale developments generate the economies of scale necessary to bring down the per unit cost of fit-for-purpose ventilation systems, but until the regulations insist on something better than 'natural' ventilation, most developers are likely to just continue on knocking holes in walls.

Photos: fourwalls

INTERNATIONAL SELECTION



Photos: Andrew Michler

Passive House mountain cabin, Colorado

Words: Andrew Michler, designer

Colorado's first project to be certified by the Passive House Institute is an off-grid timber home located 2,000 metres up in the Front Range of the Rocky Mountains, near Fort Collins. The house's pristine forest location inspired a building system with an emphasis on natural materials, that minimises the use of foams and concrete.

The dwelling's wedge shape provides good solar gain to the south, while also preserving adjacent Ponderosa pine trees, which in turn provide summer shading. Meanwhile, the north and east elevations evoke the distinctive local hogback mountain ranges, with the roof plunging into the ground — emulating a geological massing, which also creates unique internal spaces.

The main floor features an open plan living space, sunken shower, small kitchen, large bedroom, and workspace. The upper floor contains a small bedroom and storage area. A 'net bed' separates the two floors, but allows them to remain visually and acoustically connected — and provides for an occasional afternoon nap, too.

Inspired by contemporary Japanese homes, the 116 square metre floor plan is largely open to emphasise views, communication and natural light. The finishes are simple, natural and durable materials: plywood, cedar pickets, gypsum, slate and ceramic tiles.

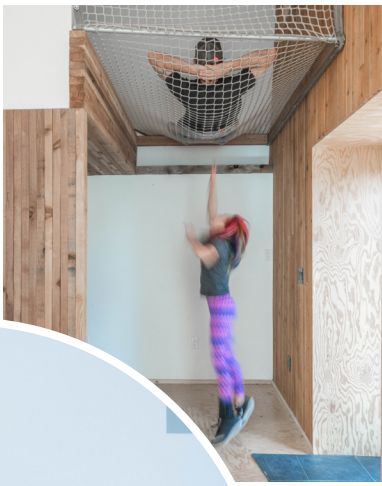
The workspace and upper bedroom features cedar nail-laminated wall and floor, allowing for a thin floor plate —thus increasing room height — and reducing the need for finish materials.

The construction consists of a lightweight timber framed interior wall, sheathed in airtight taped plywood. A larsen truss cavity filled with cellulose is encased to the exterior with mineral wool board. This assembly, along with tempered triple-glazed windows, fibre cement siding and the steel roof, is wildfire resistant and vapour open to the exterior.

Heating is supplied by a gas-fired hot water tank which is pre-heated by solar photovoltaic panels, with hot water delivered to wall-based heating pipes and a coil in the heat recovery ventilation (HRV) system. The HRV unit, located in the upper storage space, is oversized for the building volume and incorporates an earthtube system under the house, which helps to eliminate the need for electric pre-heating in cold weather. It also helps to cool incoming fresh air in summer.

And to eliminate the significant levels of foam and concrete typically used in a passive house foundation, the house was instead built over a crawlspace, with cellulose-insulated I-joists bridging the stem walls of the house.

Andrew Michler is a certified passive house consultant, building designer, founder of Passive House Rocky Mountains, and author of '[ours] Hyperlocalization of Architecture'. ▶



Want to know more?

The digital version of this magazine includes access to exclusive galleries of architectural drawings and stunning photos we had to omit from the magazine.

The digital magazine is available to subscribers on www.passive.ie

Photos: José Hevia

MM House, Majorca

This jaw-dropping new passive house in Majorca, designed by architecture firm OHLAB, is grouped into four separate boxes, each with a different function — the kitchen, living-dining room, main bedroom, and guest bedrooms.

The bedrooms face east towards the garden and a local castle, the living and dining rooms face south-east over the sea and garden, while the kitchen faces the vegetable garden to the south.

“Each box is placed carefully on the ground, and rotates on its axis with precision, to find the best views and orientation,” say the architects. The floor area is also a relatively modest 136 square metres.

Smaller openings on the opposite side of each facade allow for cross ventilation from local east-west breezes. The southern windows are recessed to allow sunlight in during winter but protect from overheating in summer, while the east and west openings have exterior shutters. “Thanks to this design cooling is not necessary, which is typically an issue in the hot days of Majorca’s summer,” the architects say.

MM House was constructed with externally-insulated brickwork. And being in the hot Mediterranean climate, the house was able to meet the passive house standard with relatively modest amounts of insulation by British and Irish standards, and with just double glazing.

Meanwhile the house’s four pitched roofs all collect rainwater — three for irrigation, and one for treatment and consumption within the house. This system provides 100% of the house’s water needs. What’s more, during the winter of 2014/15 the air-to-water heat pump wasn’t used for space heating at all — the house maintained a comfortable 21 to 24C inside with no active heating whatsoever.

“The reason that passive house works, is because you don’t get drafts. I’ve had houses where I’ve tried to control drafts coming through the floor, through the doors and they’re the things that make you cold. It’s like being out in the wind.”

Photos: Keith Hunter Photography

SIMPLE & STUNNING

Highlands passive house

MERGES OLD & NEW...

While embracing traditional farmstead design made it trickier for this new build home in the Scottish Highlands to meet the coveted passive house standard, mixing modern standards of super-insulation with vernacular farmhouse architecture ultimately led to the creation of a very special home for proprietors Jeanette and Jon Fenwick — one that picked up a coveted UK Passivhaus Award in 2016.

Words: Ben Adam-Smith

Self-build projects are all encompassing. They take time, mental energy and of course money. Perhaps this is why many self builders are those who are either approaching retirement or have retired: they have life experience and time to focus — and often their kids have flown the nest. So at this stage, with different wants and needs, what do you build and where?

Jeanette and John Fenwick have always loved the Scottish Highlands and envisaged a retirement there, packed with outdoor pursuits. So they decided to relocate from their three-storey Victorian house in north east England (and escape the house's 39 steps from top-to-bottom). Their decision to self build came out of necessity, because they simply couldn't find what they wanted — a contemporary, comfortable and healthy single-storey home with a connection to the rugged Scottish landscape.

As part of their research they attended the Scotland Housing Expo 2010 in Inverness, where they were not only introduced to the passive house concept, but got to visit a terrace of three certified houses that were part of the expo's innovation showcase. Both Jeanette and John liked what they saw. Jeanette comments: "The whole concept of not having huge heating bills, and building a house that was going to be comfortable, was important to us."

With a scientific background, John continued the research on passive house at home: "I just started to google it. And the more and more I read on the internet, the more I decided well, yes, this is the sensible way to build a new house."

They went on to engage HLM Architects, the firm behind the passive house terrace in Inverness. Having searched online and then visited a number of plots, one stood out. It was just outside the hamlet of Gorstan, a former crofting site, and afforded magnificent views of the Highlands yet was just an hour's drive to Inverness. The plot was far from straightforward though. There was quite a high water table and a lot of rock on the sloping site. HLM Architects worked closely with Jeanette and John to appraise whether the site was suitable for a passive house, and how they could accommodate their design ideas.

Jeanette explains: "I wanted it to look very much like a traditional house, rather than going for something that was a bit box-like. I like the traditional slate roof and the white rendered look, but [wanted] to contextualise it and give it a contemporary update."

The kitchen would be the hub of the home, and there would be good connectivity between rooms as well as to the rugged environment outside. They wanted a house far from most people's perception of a bungalow — a generous, light and airy, modern building, constructed with traditional materials, and incorporating some double height spaces. The comfortable and even temperatures that passive house affords also influenced Jeanette and John's decision to put higher, more open plan spaces into the brief.

While passive house design often leans towards a cubic form, Jeanette and John wanted a typical L-shaped farm dwelling, so it was a question of rising to this challenge. As the design responded to the site, the longer living wing was oriented south to make the most of the solar gains, while the bedroom wing faced east to get the benefit of morning sunlight.

Ross Barrett from HLM Architects says: "We were keen to make sure that the main rooms, such as the living room, were double height spaces. That gave us challenges in terms of moving air around the house. Likewise with the bedroom we went for a double height space, and the central space in the house as well. But it meant we had to, for example, beef up some of the walls to get better U-values, and to look very carefully at the design of the MVHR system to make sure air moved around the house sufficiently."

The couple considered a ground source heat pump, but the geology of the site would have made installing one tricky. So they opted to install an air source heat pump, which supplies

towel rails in bathrooms and a post heater in the MVHR system.

The house also features a standalone, room-sealed wood-burning stove in the living room for extra heat on cold days. Not only did Jeanette and John like the idea of having a wood burner in their home, but it made sense because wood is so plentiful in the area. The couple explored the option of a back boiler, but the logistics of concealing the pipework and the length of pipework runs proved to be an obstacle.

There's one additional heat source on the other side of the house, a far-infrared heater in the main bedroom which also doubles up as a wall mounted full-length mirror. It's programmed and thermostatically controlled by a wireless thermostat in the room. It's economical to run, and heats the room and occupants without introducing convection effects into the room.

Planning for the project was relatively straightforward. When Jeanette and John bought the plot, it already had outline planning permission for a single dwelling and a garage. The new house was then placed in a similar location on the outline plan. The architect took a detailed 3D model of the site and the planned house to a meeting with the planners prior to submitting the application. This, and a detailed design and sustainability statement in the form of an A3 booklet, meant that the planning officer was well briefed in advance of the application, which was approved.

The house was constructed with an off-site prefabricated timber frame which is a 300mm deep twin-stud system. The system had also been used for the passive house terrace in Inverness, so Jeanette and John thought it was sensible to go with it, given the architects had already used it to deliver a passive house scheme. However, in the end they had to use an alternative supplier of the panels, which were equivalent in performance, due to the initial supplier closing down.

One of the biggest challenges of the project, it turned out, was finding a contractor to undertake the work. This was largely down to the rural location and the fact that Jeanette and John wanted a fixed price contract. The company that had built the passive house terrace showed interest but didn't tender.

John says: "We settled with a main contractor who sub-contracted to people that he regularly used for his projects. Some of these turned out to be better than others in appreciating the need for high quality execution of the build to achieve the high level of airtightness the passive house [standard] demands. We had a traditional rather than a design-and-build contract with the architect. He effectively project managed the build and ensured the standards were met."

Architect Ross Barrett feels one key lesson learned from the project is to involve the airtightness tester early on — thus helping to identify leaks in the airtight layer early, make tradespeople aware of the issues, and rectify them as soon as possible.

Once the timber panels were up, they were clad in blockwork externally, finished with white render. There's also some limited use of stained timber cladding.

The project took the best part of five years to complete, but John and Jeanette have achieved something special. Natural light is apparent through the oversized windows, and each picks out a different view of the dramatic hills. It's also worth remembering that the Scottish Highlands frequently dips down to -10C in winter — so a steady 19C inside all year around is quite welcome.

The couple have now been living in the house since the end of 2014. John says: "The one thing that I have noticed which has really surprised us, and I think the reason that passive house works, is because it's so airtight and so highly insulated you don't get drafts in the place. I've had houses where I've tried to control drafts coming up through the floor, through the doors and they're the things that make you cold. It's like being out in the wind. But I think the lack of drafts has been the thing that really made it work for me."

Architect Ross Barrett has estimated that John and Jeanette spent just £157 during 2015 for electricity-based heating, out of a total electricity bill for the year of approximately £835.

Tigh na Croit is one of the most northerly certified passive house schemes in the UK. Undoubtedly this modern interpretation of a traditional farmstead has been a success.

The strong sense of place and local identity is impressive. Recognisable details of highland rural forms are evident in terms of the chimneys, roof pitch, verges, eaves and carefully placed openings. The house was even the winner in the 'rural' category at this year's UK Passivhaus Awards.

While HLM Architects' staple is larger projects, there's a great deal of pride in what they've created here. Ross says: "It's been very important for us as a practice to really try and develop our knowledge and understanding of passive house, and we're really proud of this building. We think it really is informed by its context, by its site. It really nestles down perfectly well into the site, into the existing contours of the site. There are some great big fantastic oversize windows which allow you to enjoy the views, but at the same time the house is really private. You're not overlooked, and it's just a fantastic place for John and Jeanette to enjoy retirement."

If this project demonstrates anything it's that a passive house doesn't restrict designers and that buildings don't have to be box-like. You might have to work a little harder to reach the standard — but the architecture can lead the way.

2016 STRUCTURAL TIMBER AWARDS WINNER
BEST LOW ENERGY PROJECT
CYGNUM TIMBER FRAME

OFFSITE AWARDS 16
WINNER
BEST USE OF TIMBER
CYGNUM TIMBER FRAME

2016 STRUCTURAL TIMBER AWARDS WINNER
BEST USE OF TIMBER FRAME
CYGNUM TIMBER FRAME

CYGNUM® PASSIVE

SETTING STANDARDS IN SUSTAINABLE LOW ENERGY BUILDING

Cygnum has successfully designed and installed many award winning Passive House buildings. We supply and install Passive certified and low energy timber frame structures for schools, care homes, residential housing and commercial buildings throughout the UK. We offer our clients Passive wall solutions tailored to suit their needs. Tell us what your target U-value is, your preference on green technologies and airtight solutions and we will offer a solution to suit. Our team of experienced engineers, designers, energy efficiency and construction experts can bring this wealth of knowledge and experience to your next project.

CERTIFIED COMPONENT Passive House Institute

CONSULTANT CERTIFIED PASSIVE HOUSE CONSULTANT

PASSIVE HOUSE ASSOCIATION OF IRELAND

Passivhaus Trust

Cygnum Timber Frame Ltd
Stowmarket Business Park
Ernest Nunn Road
Stowmarket
Suffolk
IP14 2ED

t. 01449 771782 info@cygnum.co.uk
f. 01449 774009 www.cygnum.co.uk

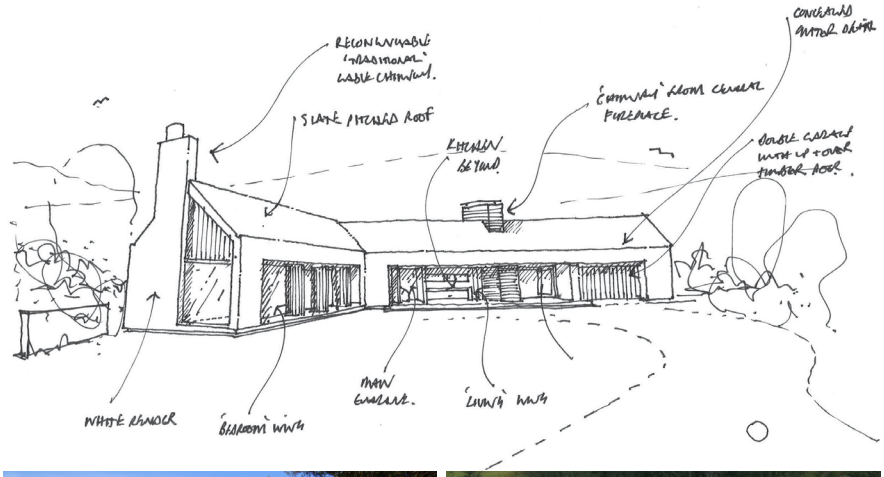
CYGNUM® TIMBER FRAME

SELECTED PROJECT DETAILS
Clients: John & Jeanette Fenwick
Architect, project management & passive house design: HLM Architects
Contractor: Urquhart Homes
Structural engineer: Woolgar Hunter
Passive house certification: Passivhusbyran
Drainage engineering: Gunn MacPhee
Mechanical contractor: CJC Plumbing
Electrical contractor: Loch Ness Electricals
Airtightness tester: Airtight Build
Timber frame system: Unitek
Fibreglass insulation: Superglass
Additional wall insulation: Kingspan
Floor insulation: Kingspan, Tremco Illbruck
Airtightness products: Glidevale
Windows: Internorm
Bespoke window: Katzbeck
Roof windows: Fakro
Air source heat pump: Nibe
Wood burning stove: Ecoliving
MVHR: Paul Scotland
External render: K-Rend
Larch cladding: Russwood
Slate: Siga Natural Slate

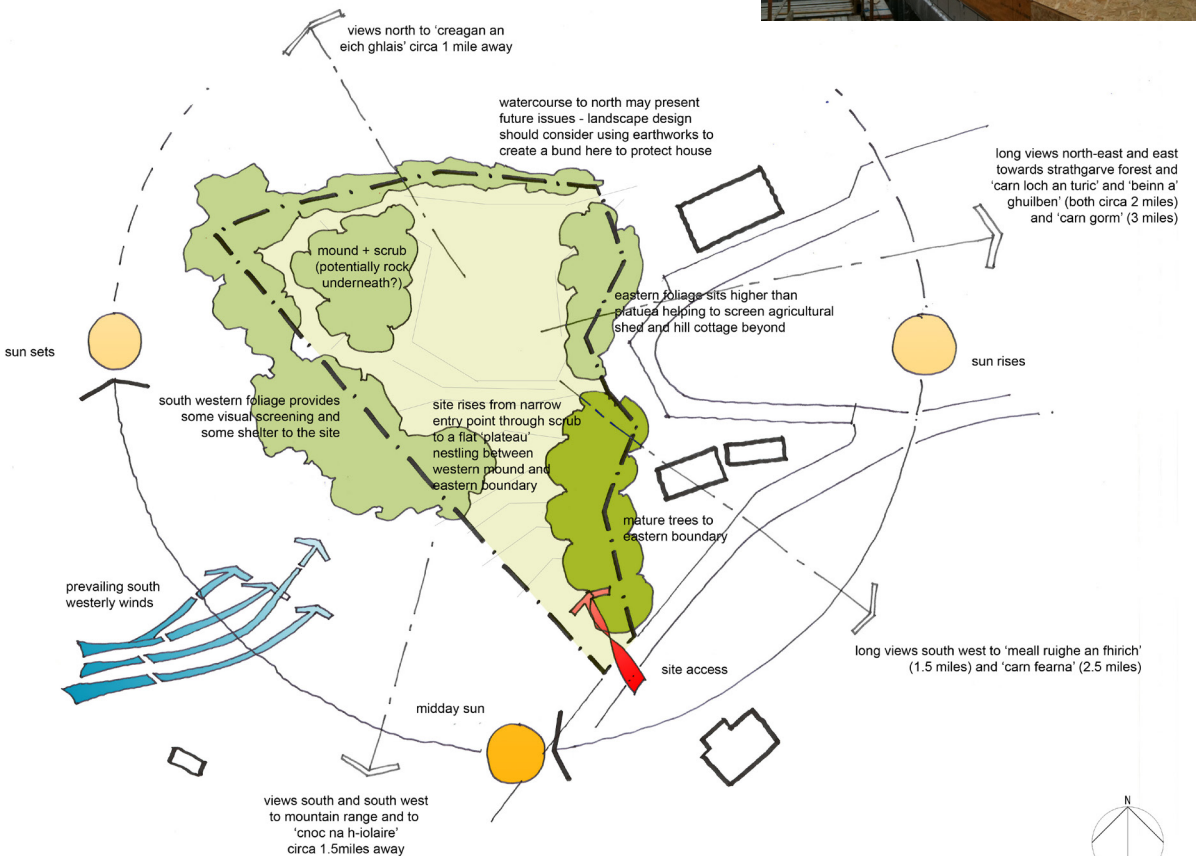
Want to know more?

The digital version of this magazine includes access to exclusive galleries of architectural drawings.

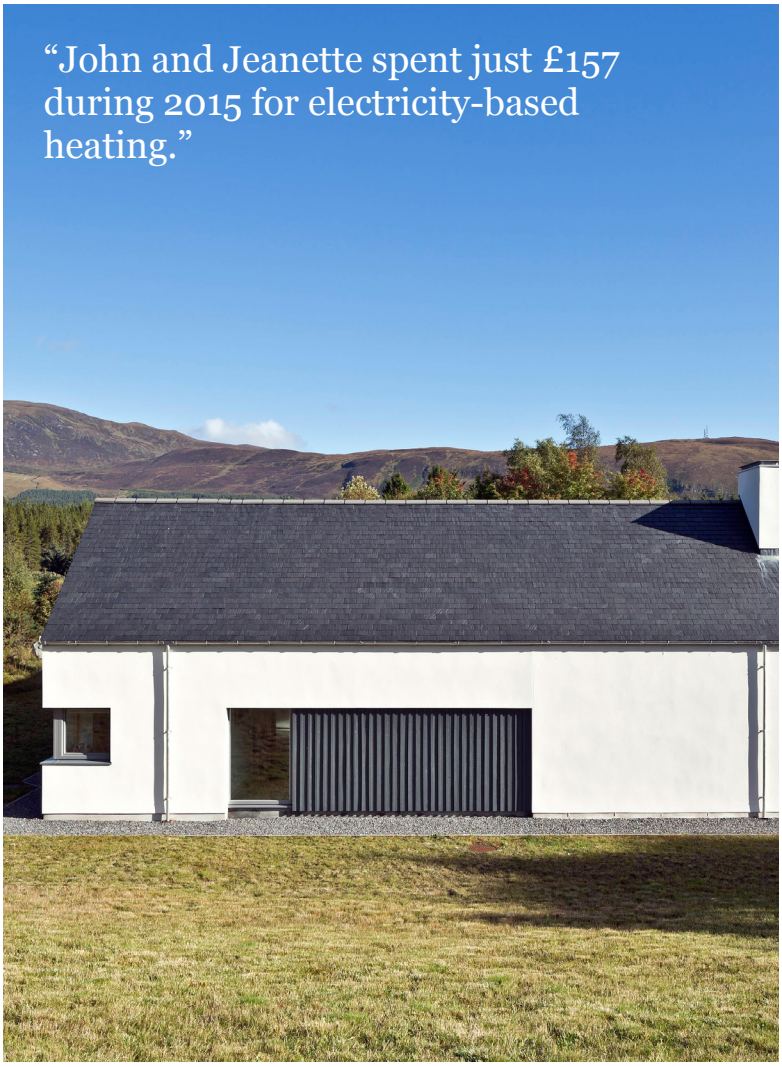
The digital magazine is available to subscribers on www.passive.ie



(top right) architect's design sketch of the L-shaped house, based on traditional farmstead style; (photos, clockwise from top left) the plot just outside the hamlet of Gorstan is a former crofting site, and sloping rock and a high water table both proved a challenge here; aerated foundation concrete blocks around the perimeter of the house at ground floor level; vapour control layer taped and sealed to OSB layer on the inside of the timber frame structure; construction of the timber-roof, with the external OSB layer seen here prior to the installation of the breathable roofing membrane and slate finish; erection of the timber-frame system at the site, which offers sweeping views of the Scottish Highlands; (below) architect's site analysis illustration indicating views, orientation, topography and climate conditions on the remote site.



"John and Jeanette spent just £157 during 2015 for electricity-based heating."



PROJECT OVERVIEW

Building type: 223 sqm TFA detached 1.5 storey new home. Timber frame with external blockwork leaf.

Location: Gorton, Ross-shire

Completion date: Nov 2014

Budget: £356,000

Passive house certification: Certified passive house

Space heating demand (PHPP): 15 kWh/m^2/yr

Heat load (PHPP): 13.4 W/m^2

Primary energy demand (PHPP): 97 kWh/m^2/yr

Environmental assessment method: Scottish Sustainable Building Regs Section 7, Silver Active label (+ Part Gold)

Airtightness (at 50 Pascals): 0.6 ACH

Energy performance certificate (EPC): C 79

Measured energy consumption: Based on electricity bills, 8275kWh / 37.1 kWh/m^2/yr total electricity consumption (so including heat pump and all appliances, but not wood burning stove) for 2015 calendar year. Total electricity bill for 2015 estimated at £835 (10.09p per kWh) plus £57 standing charges. By subtracting measurements and estimations of non-heating related electricity usage, electrically-based heating during 2015 (air source heat pump, infrared panel) is estimated at 1156 kWh during 2015, or 7 kWh/m^2/yr (cost of £157).

Thermal bridging: Thermal bridging designed out / minimised through use of timber frame. All window reveals insulated. All junctions / details thermally modelled.

Ground floor: 140mm aerated foundation blocks, 150mm thick concrete slab on separating layer over 200mm Kingspan TF70 Insulation, with 100mm insulation to slab edges. **U-value:** 0.1 W/m^{2}K

External walls (render): Acrylic K-Rend render on 100mm dense block, followed inside by 50mm cavity, on thermal breather membrane, on 10mm OSB, on prefabricated twin frame consisting of 140mm SW stud, gap, 70mm SW (studs packed with 300mm mineral wool insulation), 10mm OSB to inside face with vapour control layer taped and sealed, service gap formed of 38mm SW battens, 12.5mm plasterboard taped and filled. **U-value:** 0.11 W/m^{2}K

External walls (timber clad): Locally sourced Scottish larch (stained grey) on SW battens/ counter battens on thermal breather membrane, on 10mm OSB, on prefabricated twin frame consisting of 140mm SW stud, gap, 70mm SW (studs packed with 300mm mineral wool insulation), 10mm OSB to inside face with vapour control layer taped and sealed, service gap formed of 38mm SW battens, 12.5mm plasterboard taped and filled. **U-value:** 0.12 W/m^{2}K

Roof: Siga slate on battens / counter battens, on breathable roofing membrane, on 10mm OSB, on 300mm I-joists packed with 300mm mineral wool, on 10mm OSB to inside face with vapour control layer taped and sealed, 50mm service gap formed of 50x50mm SW battens, 12.5mm plasterboard taped and filled. **U-value:** 0.12 W/m^{2}K

Windows: Internorm Edition composite timber / aluminium triple-glazed argon filled windows. **U-value:** 0.8 W/m2K

Roof Windows: Fakro FTT U8 quadruple-glazed composite timber / aluminium centre pivot windows. **U-value:** 0.68 W/m^{2}K

Heating system: NIBE F2015 air source heat pump (COP 4.21) with 200L tank and buffer supplying wet towel rails (by heating circuit) to bathroom / en-suites, water-based post heater in MVHR. Electric infra-red panel heater to bedroom. 5kW Contura 51L wood burning stove with ducted air supply.

Ventilation: PAUL Novus 300 heat recovery ventilation system (92% efficient according to PH Certification) complete with water based post heater.

Lighting: Low energy LED lighting throughout.

“It is amazing how wobbly a pile of straw-bales are, and then how strong and solid the wall becomes when compressed.”

Photos: Hannah Devereux

Norfolk straw-bale cottage *aims for passive*

Passive house design is often seen as belonging to the world of hi-tech construction — perhaps unfairly, seeing as it emphasises a good building fabric over bolt-on technologies. Straw-bale construction, meanwhile, is usually regarded as the preserve of only the most committed, do-it-yourself eco-builders. To some these two approaches appear to be chalk and cheese, but in fact they are inherently compatible, and more and more projects are now combining the maths-centred approach of passive house with the extensive use of natural materials. In the first of a series of case studies on passive straw-bale dwellings, Lenny Antonelli spoke to architect Fran Bradshaw of Anne Thorne Architects, who designed and built a straw-bale home for herself in Hickling, Norfolk two years ago — and aimed to meet the passive house standard while doing so, with only a single infrared electric panel as the building's sole active heat source.

(clockwise from top left) concreting of the raft foundation, which was insulated with 350mm of EPS; the roof of the cottage is finished with local reed thatch; erection of the primary timber frame, which supports the roof and first floor windows; Foamglas insulation was installed at the edge of the raft foundations to prevent thermal bridging here; the timber frame being craned into place on site.

Fran, as the architect, project manager and client here, you've designed and built one of the UK's few straw-bale houses that explicitly aimed to meet the passive house standard. What were your overall goals here — and why build with straw-bale?

High performance in building often means sophisticated technology and complex manufacturing, but I think some of the most effective performance in buildings is achieved with minimally processed natural materials.

Natural materials also speak to our senses. I am interested in the materiality of buildings — what is it actually made of, how do those materials work, what does the building feel, sound and smell like? The acoustic qualities of rooms with timber and clay surfaces are quite different from those created by more highly processed materials, and other senses are involved too. The feel of timber, or the gentle and vibrant colours from light on natural paints, renders and woods are enormously pleasurable. The smell of materials is something we unconsciously respond to. We do not have nearly enough information about how these affect our sense of wellbeing.

Our experience of straw-bale building at the Lordship Rec Ecohub, which Anne Thorne Architects (ATA) designed for London Borough of Haringey, was compelling. People loved doing the straw-bale building. Suddenly in a commercial building programme, there were a bunch of people having fun, sharing the making of something that was going to benefit local people. On completion, people kept saying how beautiful the building was. This seemed to be a response to a sense of tranquility one has inside the building.

The Hickling house project wasn't really work. I was building a house for myself, family and friends — they could all come and join in making it, and in some way it could also become partly theirs. I wanted to make a lovely place to be, but also it was an opportunity to experiment.

Our design team included myself from ATA, Barbara Jones of Straw Works, Jim Blackburn from the Timber Frame Company, Alan Clarke as services engineer, and airtightness designer Paul Jennings. I was able to choose who to work with on this project, which was a great pleasure. We agreed prices, there was no tendering process, and many contributed to the design as well as to the building.

We wanted to bring together two things people often see as contradictory — high performance technologies and the use of natural materials — to make a house people could enjoy living in. The passive house standard was developed with both comfort and low energy performance in mind. Using the Passive House Planning Package as the design tool, using high tech windows and mechanical ventilation with heat recovery, achieving a high level of airtightness, minimal thermal bridging, and the kind of building accuracy required to achieve all that, is one part. The other part is using the sophisticated and subtle qualities of low embodied energy natural materials in an effective way.

Can you explain how the straw-bale structure was built exactly?

We proposed a primary framed timber structure, like that we had designed at the Ecohub — but in this case a traditionally designed morticed, tenoned and pegged Douglas fir frame. The straw-bale walls are self-supporting, but the roof and first floor and windows are supported by the primary frame. The timber sections are 200 x 200mm in order to take the three dimensional pegged joints. Secondary timber members are needed within the straw-bale walls for fixing windows — passive-certified triple-glazed windows are very heavy — and the secondary timbers are in turn supported by the primary frame.

People see straw-bale construction as quite a simple form of construction. However because it is so immensely thick, the issue of supporting windows and doors — also a problem in wide cavity construction — needs to be solved. It depends on timbers built into the wall to provide support for windows. Each straw-bale is bound together with two strings, and these divide the bale into three, so cutting a slot for the structural post has to happen in the centre of the bale. Windows and doors are fixed to these posts in the centre of the straw-bale wall. In this project the secondary structural timber

elements (100x100mm posts) are tied back to the primary frame inside the building through the cantilevered first floor joists and rafters.

As you say, the idea of building a straw-bale passive house in the UK was a bit experimental. Which bits of the experiment would you say worked out particularly well?

What was innovative and worked really well, was designing the structure to incorporate compression plates for the compression of the straw-bales. Bales need to be methodically baled to the right tension as they are cut, and this requires quite a good level of oversight by the farmer, which is why you should be choosy about the bales. Then they are compressed to achieve a solid wall. It is amazing how wobbly a pile of bales are, and then how strong and solid the wall becomes when compressed. Hazel pins are used each three or four bales high, and three bales apart horizontally, to tie it all together. The first floor joists and the roof rafters were both extended into the wall, with a compression plate fixed to their underside. The bales could then be compressed downwards, and Barbara from Strawworks uses simple car jacks to do this. Once they have been compressed, the last bale is slid in, and the jacks released.

Secondly we were able to fireproof the roof thatch and use its contribution to the thermal insulation of the roof, by using vapour permeable calcium silicate boards. These were then Tescon-taped on the outside to create the roof airtightness layer. Plasterboard would also have been a possible material, but the vapour permeability isn't so good, and any wetting during building work would have damaged its performance.

And what didn't work out so well?

What didn't work so well was our decision to create the airtight layer for the walls on the outside render layer — the final airtightness achieved was 0.87 air changes per hour. It seemed a good idea with this kind of primary frame construction, because of all the internal penetrations from the frame, which has lots of shakes and splits in it (and thank you to those at the International Passivhaus Conference in 2013 who said it was a daft idea, but to try it out and let them know what happens!).

The problems were twofold: external tape failure possibly due to a combination of temperature and moisture, and discontinuities in the render layer where the abutting brick walls of the larder and stores were built too close to the straw. Neither of these problems were wholly remediable. In retrospect my view is that an internal airtight layer is required with this kind of construction. The straw needs to be closed to the inside, for fire protection as well as to reduce the number of spiders! We did quite a lot of remedial work internally with burnt sand and linseed oil mastic, which I found to be very flexible and durable.

Hertfordshire-based Good Architecture has recently completed a house using loadbearing straw-bale, which may be easier to make airtight internally — they have achieved passive standard airtightness and passive house certification.

The form of a traditional thatch cottage seems to lend itself well to the passive house standard, which is more easily achieved with simple compact forms, oriented south. What were you trying to achieve in terms of shape, layout and orientation?

It is a very simple plan and building form, and the traditional asymmetrical steeply pitched thatched roof creates lovely spaces inside. Two years later, and with a developing garden around the house, the building sits well in the landscape around it. On the north side, the thatch continues over single-storey brickwork to create a larder outside the thermal envelope, where the temperature is consistently low.

The building demonstrates the age old principle of south-facing windows for deeply penetrating sun in winter. We have made an external pergola to support solar thermal panels and provide summer shade, but in fact the two summers so far suggest that overheating is not an issue — overhanging thatch protects against solar penetration in the summer, and there is almost always a sea breeze here.

The solar gain from windows provides a high percentage of our space heating demand, estimated in PHPP as half the overall heat gains. We've been able to use this without any overheating because it is easy to open windows. We have also had a large percentage of solar hot water, something I will be monitoring more accurately this year.

With such extensive use of natural materials, you obviously wanted to ensure these materials were exposed and shown off?

Yes. Seeing the timber frame inside the house reveals the structure. External lime render and internal clay plaster were supplied by Wormesleys who we had worked with previously, but undertaken by an excellent local plasterer who had never used these materials before and was used to achieving very flat and plumb surfaces. He came to enjoy the material and felt that rounded reveals were what worked with straw. I like the contrast externally between the duvet-like form of the render and the mechanical straight lines of windows and stainless steel cills. I was also particularly pleased that we were able to use reed thatch cut a couple of miles away.

Did you learn anything unexpected on the project?

Since building the house, I have become very interested in the acoustic qualities of spaces, and how these unconsciously affect our sense of comfort. Buildings built to the passive house standard are very quiet inside (when windows are shut) because of the airtightness and insulation. All external sounds are so much reduced that internal noise becomes important. Alan Clarke, services engineer, proposed that the MVHR should be in a partially insulated north-facing shed, and the ductwork designed

(clockwise from middle left) 'starter' hazel pins at the base of the straw-bale walls; bales being notched into place around the timber-frame structure; the bales were compressed in place using a conventional car jack; the team laying the bales to construct the walls of the cottage.

urban | front®
#doorcouture

passive house certified doors

steel reinforced natural hardwood doors | made and designed in UK
entrance doors | **internal feature** doors
| **garage** doors | **oversized** doors

urbanfront.com | 01494 778787

naked house

Contact
support@nakedhouse.co.uk
0203 411 5660
0203 740 6660
0203 740 6661

The UK's solution to building a **Passivhaus**

naked house is the easy solution for contractors and self-builders alike to construct economic Passivhauses

- **Complete construction** insulated, weather and airtight
- **Pre-fabricated** with windows and first fix installed offsite
- **Guaranteed**
- **Sturdy** timber frame system
- **Expert design of integrated heating/HW & MVHR system,** fully installed & commissioned
- **Custom design** finished to your own specification
- **Super fast build** short construction time
- **Full PHPP calculations included**
- **Full architectural design service available**

www.nakedhouse.co.uk

GreenSteps®

Princedale




(above, left to right) hazel pins in the straw-bale walls; infill bales around the timber frame structure at first floor level; thatching of the roof by Norfolk Thatchers, who used local reed thatch; Isolair woodfibre insulation and airtightness detailing around windows prior to rendering.

by Green Building Store was well installed so that the MVHR is almost inaudible. In winter I sometimes miss hearing the birds, and might open a window at night, but mostly I appreciate the comfort and enjoy how little energy is being consumed.

It is the clay plaster and straw-bale wall mass which creates a very different acoustic environment inside. I noticed as soon as we moved in, with very little furniture and furnishings, that the room was not at all echoey, but neither is the sound deadened. It seems the right balance of reverberation and damping is easily achieved with this construction. Musicians who recently played in the ground floor room commented on the excellent acoustics. I think now that the acoustic properties of spaces may be influencing our behaviour much more than we acknowledge or realise.

We've heard some people express concern about straw-bale construction in the British Isles before, because of the risk of moisture getting into the structure and causing rot. What's your take on this?

There is very little monitored information on straw-bale wall construction, and in particular we don't know enough about how moisture affects their long term durability, so we are using the AECB monitoring tool Onmiscense. We installed 10 temperature and moisture sensors in the walls as we built them, with one measuring internally and one externally too.

So far we can see that inner side of bales has dried nicely, well under 15% Wood Moisture E, which means low risk of rot. The outer sides have dried a fair bit over the last two years, but moisture in the outer side of bales in the most exposed areas could potentially be allowing some mould growth. On the other hand lime render has a high pH which inhibits growth and the summer figures (when mould growth takes place) show good drying out. We know that there is no risk to structure or windows as they are well embedded. We now have two years of data, and our plan is to keep monitoring another year or so and then do some opening up to see how the physical state is reflected in the data, I'm hoping we will be able to provide good evidence for what the straw-bale experts say — that durability is excellent.

The cottage has been heated mainly by a single infrared electric panel. What was the thinking behind this, and how was it worked out?

I thought we would invest in the fabric and the MVHR rather than a full heating system. There is no gas here, and I didn't want to spend money on heat pumps or an LPG system when we would need so little heat. Rather, my plan is to invest in some solar PV when we have the money.

We do have a second plug-in heater upstairs, but we've hardly used it at all. The bedrooms are slightly colder than average in a passive house during the winter — about 18 or 19C right now.

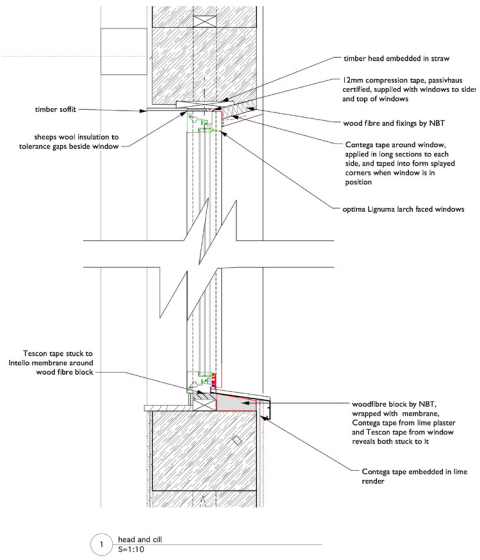
It's a fairly minimal setup, but I wouldn't read too much into it yet because the house isn't fully occupied. At the moment we're only here three or four days a week, until moving here full time, so as yet we haven't tested all the conditions and our heating figures are only approximate. We also haven't been here for a long, cold period without solar gain. From what we have experienced so far though, the panel heater would keep things going fine.

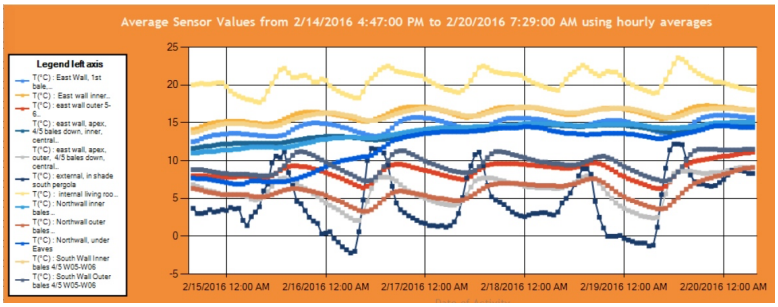
SELECTED PROJECT DETAILS
Clients: Fran Bradshaw & Georg Hermann
Architect:
Fran Bradshaw for Anne Thorne Architects
M&E engineer: Alan Clarke
Timber frame: The Timber Frame Company
Passive house designer:
Anne Thorne Architects
Structural engineer: Paul Carpenter Associates
Straw-bale design & management:
Straw Works
Straw-bales: Longhay / Thompson Brothers
General building contractor:
Broadland Builders
Plastering: Danny Rodwell
Mechanical contractor & MVHR:
Green Building Store
Airtightness products: Ecological Building Systems, via Green Building Store
Electrical contractor: Sheldon Electrics
Airtightness tester: Aldas
Magnesium oxide boards:
Ecological Building Systems
Thatching: Norfolk Thatchers
Cellulose insulation (Warmcel):
Payne Insulation
Windows & doors: Optiwin
Lime & clay plasters/renders: Wormesleys
Solar thermal: London Solar
Wood fibre insulation:
Natural Building Technologies

Want to know more?

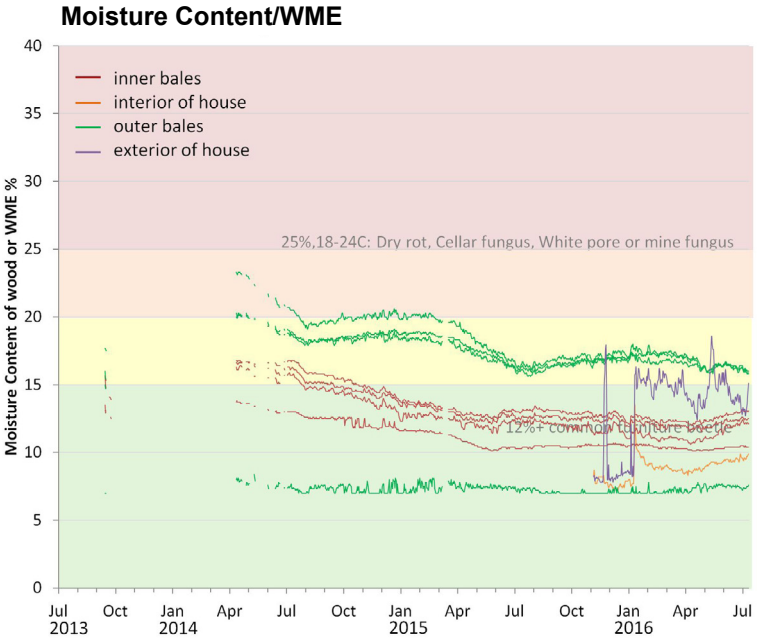
The digital version of this magazine includes access to exclusive galleries of architectural drawings.

The digital magazine is available to subscribers on www.passive.ie





Post occupancy monitoring including measurements of moisture content, or wood moisture equivalent (below); and temperature readings (above) from various parts of the building fabric, externally, and the living room.



PROJECT OVERVIEW

Building type: Two-storey detached primary frame straw-bale thatched house (TFA 120 sqm, GIFA 133 sqm)

Location: Hickling, Norfolk

Completion date: Occupied from March 2014

Budget: Approx £250,000

Passive house certification: Not certified because airtightness target not achieved

Space heating demand (PHPP): 11kWh/(m²a)

Heat load (PHPP): 11kWh/(m²a)

Airtightness (at 50 Pascals): 0.87 ACH

Energy performance certificate (EPC): B 87

Measured energy consumption (from monitored electricity bills): House is only occupied half the week normally at present, with periods of full occupation, so these are approximate calculations. Taking one three-month period during the summer of 2015, during which the house was fully occupied, shows 180kWh electricity consumption per month, while a fully occupied 2014/15 winter period had electricity consumption of 506kWh per month. This gives an approximate total energy use of 4116kWh per year (six months of each figure), which relates quite well to the total readings and occupation figures. Estimating heating electricity use, by taking the winter figure for electricity consumption and subtracting how water and appliances, gives10kWh/m², which is pretty much as predicted in PHPP.

Thermal bridging: Due to unusual construction no accredited construction details were used. Where thermal bridging occurs, dealt with as follows, from foundations upwards: Edge of raft foundations: 100mm Foamglass T4, thermal conductivity 0.041 W/mK

Below french window cills: Compactfoam CR200, thermal conductivity 0.046 WmK, density 200 kg/m³.

External to door and window frames: 35mm NBT Isolair woodfibre board insulation, thermal conductivity 0.044 W/mK

Ground floor (from ground up): 350mm EPS underfloor insulation (0.38 W/m²K), concrete raft, 50mm Thermafleece sheep's wool with timber battens between, and 27mm oak floorboards. **Overall U-value** 0.092 W/m²K

Walls: 30mm 3 coat lime render (0.063 W/m²K) externally followed inside by 450mm straw-bales (0.052 W/m²K) with straw lying vertically, 3 coat 30mm clay plaster internally (0.066 W/m²K).**Overall U-Value:** 0.099 W/m²K

Roof: 300mm Reed thatch (0.090 W/m²K) externally followed inside by air gap and battens, 35mm Isolair wood fibre t&g board (0.47 W/m²K), 12mm multi-pro XS magnesium oxide vapour permeable fire protection boards (0.47 W/m²K), 350mm Warmcel cellulose insulation between I joists (0.47 W/m²K), Glasroc plasterboard and skim. **Overall U-value** 0.088 W/m²K

External brick larder outside thermal envelope, housing MVHR. 215mm stock brickwork with 100mm woodfibre insulation applied internally.

Windows: Optiwin Liguma SuperSp Tri-Seal passive house certified triple-glazed timber windows with larch facing. g-Value 0.57. **U-values:** glazing 0.58 W/²K, frames 0.81 W/m²K, glazing edge 0.023 W/mK

Space heating: Single 800W infrared electric panel, solar PV to follow.

Hot water: Indirect sealed pressurised system with 2 x solar TWI T3 flat plate collectors and 75mm insulated 300 litre tank. Short route, insulated pipework from panels to tank. Immersion backup.

Ventilation: Paul Focus 200 heat recovery ventilation system. Passive House Institute certified heat recovery rate of 91%.

Green materials: Straw-bale walls, Douglas fir oak pegged timber frame, magnesium oxide fireboard, Isolair woodfibre insulation, thatched roofing, Wormesleys clay and lime plasters and renders, Warmcel cellulose insulation

"He went and bought a JCB, took it home and began digging the foundations himself."

DIY Cork builder

hits passive & NZEB with first self-build

Despite having no construction experience, self-builder Eamonn Fleming decided he could build a new family home more cheaply — and with better attention to detail — if he did it himself. And even though he didn't set out to build a passive house, he managed to meet the standard while doing almost all of the work in conjunction with his father, while exceeding the targets of Ireland's nearly zero energy building definition.

Words: John Hearne

When Eamonn Fleming began his self-build project in Bandon, Co Cork, he says that he knew next to nothing about the passive house standard. At the beginning, his main focus was light.

"I designed the house in such a way that we would get maximum light into it," he says. "We always seemed to end up in dark houses. Our first house in Cork city had an east-facing living area, and when we moved back to Bandon, the house we rented had a north-facing living room."

The desire to bring light into living areas inspired an offset design. The house is divided into two separate sections, one behind and slightly to the side of the other. The sections are linked by an entrance hallway and central staircase leading to the upper floor.

Photos: Jed Niezgoda

This house was granted full planning permission before the possibility of going passive ever arose. The fact that Eamonn Fleming went on to build a house that comfortably met all of the passive criteria is all the more remarkable given he had no building experience whatsoever.

Tim Horgan of Passive House Design was the passive designer and energy consultant on the build. He says that Fleming's attention to detail during the project was unbelievable. "He's the type of guy who could turn his hand to anything," says Horgan.

It was research that eventually brought Fleming around to the passive way of doing things. The more he looked into it, the more people he talked to, the more it seemed to make sense. What appealed most to him was that the passive approach gives you clear, unambiguous targets.

"It began to look like the way to go," says Fleming. "You're building to a standard, and you know if you hit all the markers, you're going to have a good quality house."

Going self-build wasn't a foregone conclusion either. It was a decision that was taken more out of necessity than choice. "Initially, I had gone to a builder and got a quote, but it was a bit crazy in terms of our budget, so we just decided we'd go self-build."

So he went and bought a cheap second-hand JCB, took it home and began digging the foundations himself. And when the building started, he recruited his dad – a retired mechanic – to give him a hand. Between them, they did almost everything.

The good news, Fleming discovered, was that designing for light is broadly consistent with passive house principles. The decision to go passive didn't prompt any changes in orientation or layout. Tim Horgan ran the design through the passive house software, PHPP, and returned only minimal changes to the plan.

Using the Killarney climate data, the software did predict a substantial overheating risk. To mitigate this, Horgan recommended a reduction in the number of roof lights and the installation of 1.2m deep louvers in the south-facing ground floor doors and windows in order to reduce the risk to zero.

Fleming went for a cavity wall construction – with a twist. The internal leaf is block on the flat, with a 300mm wide cavity, then a standard outer leaf. He considered going with external wall insulation but didn't like the way some of the external renders he had seen discoloured over time. "Sand and cement render is tried and tested in Ireland, it's stood the test of time. Plus we're only six miles from the sea here. I was confident that sand and cement would give us better protection."

The block on the flat gives additional structural support to the hollowcore floor above, plus the extra blocks boost the thermal mass of the structure. Before construction began, Tim Horgan also suggested that they borrow a design detail from vernacular architecture, building the window reveals at a sixty degree angle to the vertical.

"It's basically an old farmhouse detail, when you have very deep walls," says Horgan.

(left) the house features a double-glazed Velux roof window for natural light, with a triple-glazed Munster Joinery Passiv Aluclad window lying horizontal underneath this near the top of the insulation layer; (above) the house's utility space includes the Zehnder Comfoair 550 heat recovery ventilation system, the Heliotherm brine-to-water heat pump that supplies underfloor heating on both floors, and a 500 litre domestic hot water tank with fresh hot water heat exchanger.

"The splayed internal reveals allow the light to progress deeper into the rooms. In Eamonn's house, we have wall thicknesses that verge on the same portions as the old traditional cottages. It seemed logical to go with it."

Horgan drew up all of the thermal bridge details needed to achieve passive standards, and Eamonn Fleming installed each one himself. Horgan points out that the fact the house has quite a straightforward design, without difficult junctions, made this element of the build relatively painless.

Though no stove has been installed, there is a chimney. Fleming explains that it's effectively a false chimney. There's no chimney breast, the flue is capped at either end and only extends as far down as the attic, where it lies outside the thermal envelope.

The chimney, Fleming explains, was a kind of an each-way bet. "I wasn't sure how the house was going to work out, so I put that in, in case I ever wanted a stove. But the way things have worked out, I don't think we'll ever use it."

While the thermal bridge detailing didn't cause too many headaches, it was achieving passive standard airtightness that prompted the most research and the most work.

"I thought long and hard about letting somebody else do it," says Fleming, "but the reason I decided to do it myself all came down to trust. Let's say you had four fellas in doing it. You don't know how dedicated they are. Are they just going to put on the tape as quickly as they can and get out?"

The dilemma was complicated by the fact that the wet plaster finish would form the primary airtightness barrier, with tapes and membranes integrated at key junctions. But because these tapes would all be buried beneath the plaster, there would be no way to remediate problems if they arose.

Instead, Fleming began researching the process and went on to fit all of the tapes and membranes himself. "I just went room to room. I started at the top and worked down." The day of the blower door test, he acknowledges, was particularly anxious. "The fella who was doing the test asked what I was hoping to get. I said 'passive', and he said, 'passive is very hard to get'."

In the end, the house achieved a result of 0.22 ACH at 50 Pascals, which must be one of the best airtightness results ever achieved on a self-build in Ireland. "The most important things I think are forward planning and research, and keeping the place clean and tidy. Although everyone on the build was new to passive, I found once I explained what I was trying to achieve that people were accommodating and came on board."

Electrician William Fleming was a prime example. When Eamonn explained how he needed to bend the conduit containing the electrical cables back into the dropped ceiling, the electrician returned the next day with a circular instead of oval conduit, which was much easier to manipulate into position.

"Any time you wanted to make a break through [the airtightness layer]," says William Fleming, "you just confirmed with Eamonn that he was

SELECTED PROJECT DETAILS
Client: Eamonn Fleming
Architect: Quentin Keohane
Passive house consultant: Passive House Design
Civil & structural engineer: Donal Moynihan Consulting Engineers
Project management: Eamonn Fleming
Electrical contractor: E-Smart Electrical Contractor
Airtightness tester: Clean Energy Ireland
Cavity wall insulation: McHugh Insulation
Thermal breaks: Quinnlite, Perinsul
Cellulose insulation: McHugh Insulation
Ground floor insulation: Xtratherm
Airtightness products: Siga
Windows & doors: Munster Joinery
Roof window: Velux
Heat pump: Renewable Energy Centre
Ventilation: Flynn Heat Recovery Systems

Want to know more?

The digital version of this magazine includes access to exclusive galleries of architectural drawings.

The digital magazine is available to subscribers on www.passive.ie

(anti clockwise from top left) the ground floor is insulated with 300mm of Xtratherm Hytherm expanded polystyrene insulation; construction of the cavity-wall ground floor, with two rows of Quinn Lite low thermal conductivity lightweight concrete blocks at the wall-floor junction; the ultra-wide 300mm wall cavity, which was fully insulated with Envirobead; a suspended ceiling system to house building services inside the Siga airtight layer; MVHR ducting in the roof, with airtightness taping where the ducting penetrates the airtightness layer.

happy with that, whereas normally you'd motor away, you'd make your breakthroughs and whatever they wanted to do afterwards, they would do afterwards."

The house also scored a BER of 38.5 kWh/m^2/yr – slap bang in the middle of the A2 band. That also meant it surpasses the targets of the Irish government's proposed national definition for nearly zero energy buildings (NZEBs) set to come into building regulations for new homes this year under the EU Energy Performance of Buildings Directive. The house hit an energy performance coefficient (EPC) of 0.29, meaning it needs just 29% of the energy of the same house design if built to 2005 minimum standards.

The family moved in to the house in February 2015 and are delighted with how comfortable – and cheap to run – their new home is. Total running costs for the twelve months to March of 2016, for a family of two adults and three children, came to €326 for heating and hot water. The total electricity bill over that same period was €1,244.

"We had a quote from a builder for €265,400 to finish to a very high spec," says Fleming, "but it was outside our budget so we decided to go the self-build route and ended up going passive and finishing the house for roughly the same money."

"But you do have to throw yourself into it," he adds. "You kind of put life on hold."

PROJECT OVERVIEW

Building type: 255 sqm detached two-storey block built house

Location: Bandon, Co. Cork

Completion date: February, 2015

Passive house certification: Not certified

Space heating demand (PHPP): 9 kWh/m²/yr

Heat load (PHPP): 8 W/m²

Primary energy demand (PHPP): 70 kWh/m²/yr

Energy performance coefficient (EPC): 0.289

Carbon performance coefficient (CPC): 0.296

BER: A2 (38.5 kWh/m²/yr)

Measured energy consumption: 21.7 kWh/m²/yr (March 2015 to March 2016, 5548 kWh total electricity consumption, including heat pump, divided by 255.5 square metres)

Energy bills: €326 for hot water and space heating, €918 for all other electricity use (March 2015 to March 2016)

Airtightness: 0.22 ACH at 50 Pa or 0.23m³/m²/hr at 50 Pa

Thermal bridging: Two courses of Quinnlite blocks to floor level, Perinsul foamglass block with 100mm EPS 200 at threshold of doors and floor level windows

Ground floor: Strip foundation, two rows of Quinnlite to floor level, 25mm edge insulation,150mm sub floor with 300mm Xtratherm Hytherm expanded polystyrene, 75mm screed. **U-value:** 0.12 W/m²K

Walls: 18mm sand/cement render externally, followed inside by 100mm concrete block, 300mm cavity fully-filled with Envirobead, S/S wall ties, 215mm concrete block on the flat, 15mm sand/cement render. **U-value:** 0.11 W/m²K

Roof: Tegral Rivendale fibre cement slates externally on 50x35 battens/counter battens, followed underneath by Tyvek breathable roofing underlay, 175mm timber joists fully filled to a depth of 450mm with Warmcel cellulose insulation, Siga airtight membrane, 150mm uninsulated service cavity, 12.5mm plasterboard ceiling. **U-value:** 0.096 W/m²K

Windows: Munster Joinery, Passiv aluclad triple-glazed windows with argon filling and an overall U-value of 0.7 W/m²K. Munster Joinery Ultra Tech cork-insulated entrance door with **overall U-value** of 1.1 W/m²K.

Munster Joinery aluminium-clad glazed doors with **overall U-values** of 0.8 W/m²K.

Roof windows: Double-glazed Velux roof window with triple-glazed Munster Joinery Passiv Aluclad window lying horizontal underneath this, near top of the insulation layer.

Heating system: Heliotherm HP07S08W-WEB brine-to-water (vertical probe) heat pump supplying underfloor heating on both floors. Electrical input 1.51kW, heat output 6.95kW, COP 4.6 at brine temp of 0C and water temp of 35C (EN 14511). 500 litre domestic hot water accumulator with fresh hot water heat exchanger.

Ventilation: Zehnder Comfoair 550 heat recovery ventilation system. Passive House Institute certified to 84% efficiency.

A2 RATED DUBLIN SCHEME

goes high end but low energy

Photos: Donal Murphy Photography

Achieving building regulations compliance and a good energy rating is one thing. Delivering a genuinely low energy building is quite another. A new scheme by one of Ireland's most decorated developers may help show the market a way forward.

Words: John Hearne

A new residential development in Rathgar, Dublin 6 goes above and beyond the building regulations to deliver a high performance building envelope with a ventilation strategy to match. Garville Drive is testament to a belief that building to minimum standards isn't a viable strategy for any developer with long-term ambitions.

The company behind these eight mews style houses, each of which carries an A2 BER, is Montane Developments, led by Vinny Carty.

"No one's building B2 or B1 rated houses any more, but it doesn't take a huge amount of additional resources to get an A3 rated house," says Carty. "You build according to the new building regs and you'll get it. Here we've managed to go a step forward and get an A2. At the end of the day, that will save the customer a lot of money over the lifespan of the house."

These customers will however need a lot of cash to get the keys in the first place. The houses – each with a floor area 218 m^2 – are laid out over four storeys, including a basement. Prices start at €1.075 million.

Carty explains that the decision to go for a higher spec was informed in part by the fact that the development is right at the top end of the market, where it's possible to command a premium for an improved thermal performance and higher comfort. That's not the whole story however. There are also reputational issues at stake here.

"We've always built quality homes," says Carty. "Quality is always key to selling product and to attaining the best market price." That process, he explains, requires an engagement with new technologies, new ways of doing things and better building methods.

In 2015, Montane completed Chelmsford Manor in Celbridge, Co. Kildare. This is a large residential development with a mix of house types, each of which carries an A3 rating. That dedication to quality saw incremental improvements in every house completed. "As we moved through the site, we were improving a little bit all the time. Now, we're very conscious of what to check, making sure everything is perfect."

Eoin McGann of 2eva.ie was energy consultant on the build. His initial brief, he explains, was to ensure the house was compliant with Part L of the regulations, then to establish a provisional BER, and from there, to specify the changes that would have to be made to bring the houses above the A2 threshold. As Vinny Carty already asserted, these were not excessive; floor insulation had to be beefed up and an additional solar panel was specified. In addition, airtightness had to be improved.

That, says McGann, was the central challenge on the build. "My biggest fear throughout was the right level of airtightness on what was a complex design – three storeys, plus a basement, plus a flat roof."

"It's the number of junctions." he goes on. "You have flat roof sections and a basement, you have a lot of floor cassettes that you need to incorporate into your airtightness design...This required planning. It wasn't something that could have been done as an afterthought."

Vinny Carty agrees. He explains that the build team deployed a range of techniques to bolster the airtightness performance of the building before the installation of the airtightness layer itself. For example: What Carty describes as "an ample gauge" of mortar was used to embed the precast slabs at basement level, to ensure a better seal.

"We use Mitek [Posi-Joist] metal web joists," says Carty, "because they allow services to pass through them very efficiently, but before we install them, we plaster behind all joist hangers before they're fitted, to make the blockwork airtight."

The build team also used a Gyproc product called Airtite Quiet on the outer leaf. As the name suggests, it delivers an element of both airtightness and sound proofing. In combination with the sand and cement render on the inner leaf, plus the suite of airtightness membranes and tapes, these products and techniques delivered an airtightness result of 1.88 ACH @ +/-50Pa or 2.15 $m^3/m^2/hr$ – lauded by Mark Shirley of 2eva.ie as an "excellent result in light of the four-storey buildings" and the attendant complexity.

One of the big contradictions inherent in Irish building practice is that despite ever higher levels of airtightness, we're not matching that with appropriate ventilation standards. If a builder achieves an airtightness level of 5 cubic metres of air leakage per hour, or better, and chooses so called 'natural' ventilation, he must increase the equivalent area of background ventilation by 40%. Background ventilation simply means holes in the wall or trickle vents in windows.

The problem of course is that while this may or may not deliver fresh air, the thermal envelope is now seriously compromised. (Passive House Institute founder Prof Wolfgang Feist's assertion that airtightness and mechanical ventilation are as much to protect the structure

from interstitial condensation as to save energy is illustrative.) The alternative is a designed ventilation system, such as mechanical ventilation with heat recovery (MVHR).

Despite the fact that Carty did not have to install MVHR in either his Celbridge or his Rathgar developments, he opted to do so in both – Sentinel Kinetic Plus systems, installed and commissioned by Alternative Energy Ireland.

"There's no law to say we should put them in," says Carty, "but if a customer comes to me and says why did you make the house airtight, and then put holes in the wall? How do I answer that? I can't answer that. I can't give him a straight answer."

He points out that in any house, regardless of its level of airtightness, you have to get an adequate supply of fresh air in, and you have to extract the stale, contaminated, moisture-laden air.

"We all know the effects of condensation. It attacks the fabric of the building and it means you have to decorate more often, you have to replace your furniture more often, you have to replace your curtains...All these things are as a result of moisture in the house not being properly channelled."

Carty describes himself as a doubting Thomas. One of the first things he was told about MVHR was that it cost no more than €50 a year to run, something he didn't believe until he measured the energy consumption of the system in the first house in which he installed it.

"It worked out exactly as the manufacturer said. It used less than €50 a year in electricity, but it's what it saves on the other side that's even more important. As they're exhausting the stale, moist air, they're recovering the heat from it to temper the incoming cool fresh air, so if it costs €50 a year to run, it probably saves €600 or €700 a year in energy that would otherwise go out of the building. That's where the real gain is, plus the fact that it protects the building fabric."

Carty was so impressed with the first systems he installed in Celbridge, he actually retrofitted MVHR into his own bungalow – a house built 27 years ago without any airtightness measures.

"The difference is incredible. I don't have condensation any more in shower rooms or bedrooms. I'm absolutely delighted I put it in."

Condensation is one risk to manage, but in a development like Garville Drive with basements, water ingress is another that requires particular care. A Delta tanking system was installed – including a fully sealed membrane in the basement slab and external walls up to the basement ceiling, which is above the water table. John Curley of plastering contractor Ardlea Construction describes the Delta system as "the Rolls Royce System. If the water does get in, it takes care of it. It comes with a drainage channel internally, so that if the water comes back into it it goes into a sump pump. While every measure has been taken to prevent water getting in, in the event that it ever does, the pump is there to take care of it."

Heated by a combination of high efficiency gas boilers and room-sealed wood burning stoves, the Garville Drive houses also feature solar thermal panels. These are mounted on frames on the flat roofs of the houses. There are also extensive green roof systems – offering a mix of benefits including boosting biodiversity, reducing the risk of the urban heat island effect causing an overheating risk, and assisting with stormwater attenuation, and each house is fitted with rainwater harvesters, significantly reducing any exposure to water charges.

Carty remains in contact with residents in Chelmsford Manor in Celbridge. "I get very good feedback from everyone that has bought off us, and that's the proof of the pudding," he says.

Want to know more?

The digital version of this magazine includes access to exclusive galleries of architectural drawings.

The digital magazine is available to subscribers on www.passive.ie

(below, clockwise from top left) the walls of the eight units at Garville Drive were constructed from traditional concrete-block cavity-walls, with 100mm of Xtratherm full-fill Cavitytherm board between the inner and outer leafs; Gyproc Airtite Quiet plaster behind 25mm battens for the internal service cavity prior to installation of plasterboard, with airtightness detailing of key junctions using Siga tapes also visible; 150mm Paratherm PIR insulation on the flat roof, part of a Moy extensive green roof system; a Kingspan Environmental rainwater harvesting system feeds garden garden taps at the development.

SELECTED PROJECT DETAILS
Client/main contractor: Montane Developments
Architect: Duignan Dooley
Energy consultants/airtightness testers: 2eva.ie
Kavanagh Burke: Structural engineers
Carpentry & internal/external plastering contractor: Ardlea Construction
Plumbing & heating contractor: Andy Geoghegan Heating and Plumbing
Cavity insulation: Xtratherm
Airtight plaster: Gyproc
Airtight tapes/membranes: Siga
Insulation and airtight membrane contractor: Usher Insulations
Mineral wool insulation: Isover/ Rockwool
XPS insulation: Kingspan
Tanking & water management system: Delta via SIG Ireland
Roof systems: Moy Materials
MVHR system: Lindab
Ventilation contractor: Alternative Energy Ireland
Metal web joists: Armstrong Timber Engineering
Windows: Carlson
Roof lights: Williaam Cox
Condensing boilers: Vokera
Solar thermal system: Joule
Rainwater harvesting: Kingspan Environmental
Bricks: Kingscourt Country Manor Bricks
Stove: Wanders, via Lamartine

Hi-therm™ LINTELS

Remarkably advanced

Hi-therm, the single most cost efficient solution for lowering carbon emissions within SAP.

WINNER
BEST BUILDING FABRIC PRODUCT 2013 & 2014
NATIONAL HOUSEBUILDER AWARDS

New Psi value calculator available on: **hi-thermlintels.com**

Available from:
Keystone LINTELS

PROJECT OVERVIEW

Building type: Eight conventional block/ brick constructed, three-storey over basement townhouses, 186 sqm (excluding the circa 32 sqm basements).

Location: Garville Drive, Garville Avenue, Rathgar, Dublin 6

Completion date: December, 2016

Budget: €5.5M

Energy performance coefficient (EPC): 0.345

Carbon performance coefficient (CPC): 0.316

BER: A2 (46.92 kWh/m²/yr)

Airtightness: NSAI certified result of 1.88 ACH @ +/- 50Pa or 2.15 m³/m²/hr @ 50 pa

Thermal bridging: 2011 TGD Part (L) Acceptable Construction Details

Roof: Moy extensive green roof system on Paralon modified bitumen waterproofing finish, consisting of Paralon Unosint Antiradice Anti root capsheet fully torch bonded to Parabase 3kg underlayer, fully bonded to 150mm Paratherm insulation, on Parabase 2kg vapour control layer, fully bonded to primed timber deck laid to 1:60 falls and crossfalls; 254mm Mitek joist system filled with Rockwool/Metac mineral wool insulation; Siga Majpell airtight membrane; 12.5mm Gyproc Fireline board, taped and skimmed. **U-value:** 0.15

Basement walls: 12.5mm plaster board with skim finish on 90mm Xtratherm XT/ TL insulation, on treated timber battens, on Delta PT drainage membrane, on 300mm in situ poured concrete substrate, with 100mm Kingspan Styrozone down to 1m below ground level.

Basement floor: 75mm screed on polythene sheet separation layer, on 125mm Xtratherm XT/HYF insulation, on Delta MS20 membrane, on 300mm concrete slab, with 150mm Delta corner strip at perimeters and Delta sump pumps.

Ground floor: 225mm concrete slab on 125mm Xtratherm XT-UF insulation on 1200 gauge DPM. 30mm Xtratherm on upstands in perimeter areas. **U-value:** 0.12 W/m²K

Walls: Consisting of: 12.5mm plasterboard taped & with skimmed paint finish; service void with 25mm battens; 6mm Gyproc Airtite Quiet plaster; 100mm blockwork; 100mm Xtratherm Cavitytherm full fill board; variously with Retro Casa Lena brick and 100mm block on edge with Weber monocouche render. U-values as low as 0.12 W/m²K

Windows: Carlson Scandinavian pine double glazed windows with argon gas filling. Overall **U-value:** 1.34 W/m²K

Roof lights: Coxdome Glasslite low profile structually glazed rooflight system, with 16mm double-glazed argon-filled units and 6mm toughened solar control glass. **U-value:** 1.1 W/m²K

Heating system: 300 Vokera Mynute i30 mains gas condensing boiler with full time & temperature zone control with 300 Litre Joule cylinder with standing heat loss of 2.28 kWh/ day. 6.06m² Joule Vissolis solar thermal three panel arrays.

Secondary heat source: 8.4 Kw Wanders Square 68 wood burning (only) stove with external air supply and declared efficiency of 79%.

Combined renewable contribution in excess of 10 kW/m²yr with this cost-effective design and set up despite the low energy design and reduced load causing challenges within DEAP. SAP Appendix Q Certified Vent-Axia Sentinel Kinetic Plus B with tested efficiency of no less than 88%.

Water: Kingspan Environmental rainwater harvesting systems feeding a tap in the garden for watering plants and washing cars.

Photos: Stables Photography Studios

Brecon Beacons stone cottage

gets Enerphit treatment

When it came to upgrading an old stone-walled building to the Enerphit standard — with all the inherent challenges such an upgrade poses for energy, airtightness and moisture — who better to have as your client and defacto site manager than a professor of physics?

Words: John Cradden

If you move to an architectural conservation area but want to extensively renovate an existing house, this can be a tricky task — especially if you plan on retrofitting it to the passive house-based Enerphit standard.

This was the main challenge that faced Peter Blood and his wife when they chose to buy Rectory Cottage, a three-bedroomed cottage nestled deep within the environs of the glorious Brecon Beacons National Park in South Wales.

The recently retired couple, who had been living in South Wales for over 20 years, had made the decision to look for a home within, or on the edge of, a rural community. They also wanted a new build, low-energy home — but two years of searching failed to turn up a plot in a suitable location.

However, a chance meeting with local architect Patrick Thomas — who was selling a plot that they looked at but later rejected — was all it took to re-orient their plans in a completely different direction. Although Peter Blood was familiar with the passive house standard for new build, Patrick Thomas introduced him to the Enerphit standard for refurbished properties. The couple quickly converted to the concept, and started to look

for a suitable property to renovate.

Rectory Cottage was originally a small stone-walled building that had been extended twice, but it was in need of some renovation and a re-modelling of the interior to make more effective use of the space. It also came with a former stable that served as a garage and garden shed.

Patrick Thomas proceeded to draw up an imaginative remodelling for the house and brought in passive house designer Alan Clarke to advise. But Patrick later had to withdraw because of a clash with another project he was working on. So he drafted in his friend and fellow architect Simon Brown, who had also worked previously with Alan Clarke, ensuring the project stayed on track.

The team looked at a number of properties, keeping the requirements of the Enerphit standard in mind, but Peter says that one factor in favour of the purchase of Rectory Cottage, along with its simple form-factor, was that it had a rendered rather than stone finish on the outside. This meant they could apply external wall insulation without changing the nature of the finish, thus keeping the planners happy.

Sure enough, although they had to submit a number of amendments, it proved easier than expected to agree the scheme with the local planners, according to Simon Brown. “In essence, the planners considered the original building sufficiently unlovely to mean that almost any proposals would have been seen as an improvement. Therefore, we were pushing at an open door, and only had to adjust things slightly to take account of the conservation context,” he says.

Beyond that, Simon Brown’s role was limited to detailing and advising as Peter, a physics professor, had the kind of knowledge not just to understand passive house principles, but to dig deep into the science behind the standard too. “My initial instinct to having a low energy house came about because of my scientific background. I think once I got going on it, I slowly got hooked on the methodology,” he says.

A local contractor, Craig Morgan, who had been lined up to work on the house from the start, had no passive house experience but did have an instinctive grasp of the basic principles. Peter says: ”I would say he cottoned onto the idea right from the start, because when I brought him to look around and see the house as it was and I showed him what I wanted to do, his immediate reaction was to look at the floor and say: ‘you’ll need to dig the floor up, won’t you?’ — which of course was necessary to put insulation down.”

However, Craig was a little wary of dealing with the technical detail — whereas Peter was very much in his comfort zone looking over spreadsheets of passive house data from Alan Clarke. So a working relationship quickly evolved between Alan, Peter and Craig that saw Peter become a kind of intermediary, conveying the technical information from Alan to Craig in layman’s terms. Peter was also on site whenever passive house specific work was being carried out.

“It was kind of shifting some of the responsibility for ensuring the work was done up to the required standard onto me — but I was not unhappy with that because that meant, of course, I was in control,” Peter says.

All of which meant that Peter slotted into the role of defacto site manager, although he is reluctant to claim a title like ‘project manager’ because he has no experience in the building trade or any formal management training. But as the client, he was in a good position to make decisions and authorise expenditure on the spot.

Peter was also on site about three times a week, and in contact with Craig regularly by

phone. Of course input from Alan Clarke and Simon Brown remained crucial, while Craig's competence meant that no sub-contractors were needed for any of the passive house specific work. In fact, the only skill Craig didn't already have was the airtightness taping of windows, which he quickly learned.

Peter also attended the one-day construction module of the passive house designer course. "I became aware that success in achieving certification required a fanatical attention to detail, and well beyond that usually given to a traditional building. I'm used to the meticulous attention to detail needed to conduct meaningful experiments in the lab, and that stood me in good stead," he says.

He also deliberated at some length about whether aiming for Enerphit certification was worth it, but eventually opted for it, to prevent what he calls "creeping compromises". He says: "I just came to the conclusion in the end that this was a way of keeping it all on track."

Of course, obtaining certification means a bit of extra cost. In this case the fees amounted to nearly £4,000, but the whole process also served as an independent audit of Alan's design. "As part of the certification process, they scrutinise the calculations done by the consultant. And as part of that they made a number of helpful comments. So it functioned as a kind of independent check on the passive house aspects of the design," Peter says.

His wife also quite liked the idea of having a plaque on the wall, he quips. The remodelling of the house also included the construction of a link building to bridge the short three-four metre gap between the cottage and the stable, which now houses another ensuite bedroom and utility room as well as the two-car garage. But the stable building was not renovated to Enerphit standard, mainly because of the difficulty of preventing inevitable heat loss from a building with two garage doors, among other aspects.

Some of the main cottage's original stone walls were removed and rebuilt as part of the re-modelling, with the rest of the walls and cavity block extensions externally insulated with Plustherm 200mm graphite EPS with a K-Rend finish, though not before the cavity walls were filled with Walltite foam insulation. Alan Clarke says: "We had the issue of cavity walls in parts, where there was a risk of air leakage via the cavity, since the air barrier line steps from outside above ground to the new floor slab below ground, so we used expanding foam cavity fill to address this."

The original external render provided the airtightness layer for the walls, while there is an air barrier in the floor slab too, sealed to the internal plaster. The ground floor was excavated and insulated with 150mm of Ecotherm PIR insulation. The roof tiles were removed (and later replaced) to allow for the installation of an airtight vapour check on OSB with 100mm of Ecotherm on above the membrane and 90mm of Knauf Earthwool below. Meanwhile, a Paul Novus 300 MVHR unit fulfils ventilation duties, while heating is courtesy of a Worchester Bosch LPG boiler and integrated solar thermal panels, with the stable also hosting a solar PV array.

The LPG boiler is the smallest capacity available, and is still set to a very low power output. Peter says a wood pellet boiler

(clockwise from top left) installation of 150mm of PIR insulation to the original ground floor; solar thermal panels on the upgraded roof supply domestic hot water for the renovated cottage; installation of the Plustherm graphite EPS external insulation system to the gable wall; Green Building Store Ultra triple-glazed timber windows set into the external insulation layer to prevent thermal bridging; the Ultra windows in place prior to the installation of the external insulation.

was considered "but they push out far too much power, too much energy" though he acknowledges they can be modulated. In the end it was the "inconvenience factor" that put him off it," he says

Alan Clarke is one of the UK's foremost passive house experts, but says this was his first experience of using the component method of certification for Enerphit. This involves ensuring the individual components of the building fabric and ventilation system are certified, rather than aiming for an overall space heating demand figure. This method worked well at Rectory Cottage because of the poor orientation of the existing house, and because it also gave the team some leeway to allow thermal bridging at the stone wall footings.

"Peter's house is a good example since it had a blank gable wall to the south, and windows to east, west and north, so the net solar energy balance is not so favourable for a kWh per square metre calculation," Alan Clarke says. "Also there were unavoidable thermal bridges down the stone walls. The insulation installed means that the surface temperatures are now not a problem, but there is still heat loss."

The Bloods moved into the cottage last April and, while they are pleased with the finished house and happy that it meets their requirements, the litmus test will of course be its performance over the winter.

"From a passive house point of view I was initially surprised over the summer by the effect that passive energy inputs have on the internal temperature in a low-loss building, effects that were hardly apparent in our old house, like sunshine, cooking, people. But thinking about it, it's what you'd expect," Peter says.

When Passive House Plus emailed Peter at the end of November, he said it was still too soon to draw empirical conclusions on the performance of the house. "The only real test is how much energy we use for space heating over a year," he replied. "Remember, you're dealing with a physicist!"

The project came within their budget, but Peter admits that it's hard to tease out how much extra the Enerphit standard would have added to the overall cost given that the whole house needed a lot of work anyway. "But what I can say is that it wouldn't have been worth going for Enerphit if we hadn't needed to knock around the building in any case," he says.

"The one thing we were looking for was a building that needed attention."

Want to know more?

The digital version of this magazine includes access to exclusive galleries of architectural drawings.

The digital magazine is available to subscribers on www.passive.ie

SELECTED PROJECT DETAILS
Client: Peter Blood
Passive house consultant: Alan Clarke
Builder: Craig Morgan
Architects: Patrick Thomas, Simon Brown
Airtightness testing: Aldas
MVHR: Paul, via Green Building Store
Windows & doors: Green Building Store
Airtightness products: Ecological Building Systems, via Green Building Store
Passive house certifier: Warm
LPG boiler & solar thermal system: Worcester Bosch
External wall insulation: Stylite Plustherm
Cavity wall insulation: Walltite
Roof insulation: Ecotherm, Knauf
Floor insulation: Eco-Versal

PROJECT OVERVIEW

Building type: Three-bedroom detached house, stone with block-work extensions. Treated floor area of 141 sqm.

Location: Brecon Beacons National Park, Powys, Wales.

Completed: June 2016

Space heating demand (PHPP, after): 25 kWh/m²/yr

Heat load (PHPP, after): 12 W/m²

Primary energy demand (PHPP, after): 123 kWh/m²/yr

Passive house certification: Enerphit certified (component method)

Airtightness (at 50 Pascals): 0.6 air changes per hour

Ground floor: Original floor excavated and insulated with 150mm EcoTherm Eco-Versal PIR insulation. **U-value:** 0.14 Wm²K

WALLS
Before: Stone (rubble filled), with cavity block-work extensions (c.1980s)

After: Plustherm 200mm graphite EPS insulation and K-Rend external finish externally to all walls, plus Walltite CV100 foam insulation in the unfilled cavity walls. Original external plaster providing airtight layer. **U-value:** 0.12 W/m²K

ROOF
Before: Pitched roof, tiles externally, no insulation, insulated plasterboard ceiling.

After: New roof tiles externally, on battening, on 100mm Ecotherm PIR, on Pro Clima DA airtight vapour check, on OSB, on 90mm Knauf Earthwool insulation between rafters. Warm loft space. **U-value:** 0.15 W/m²K

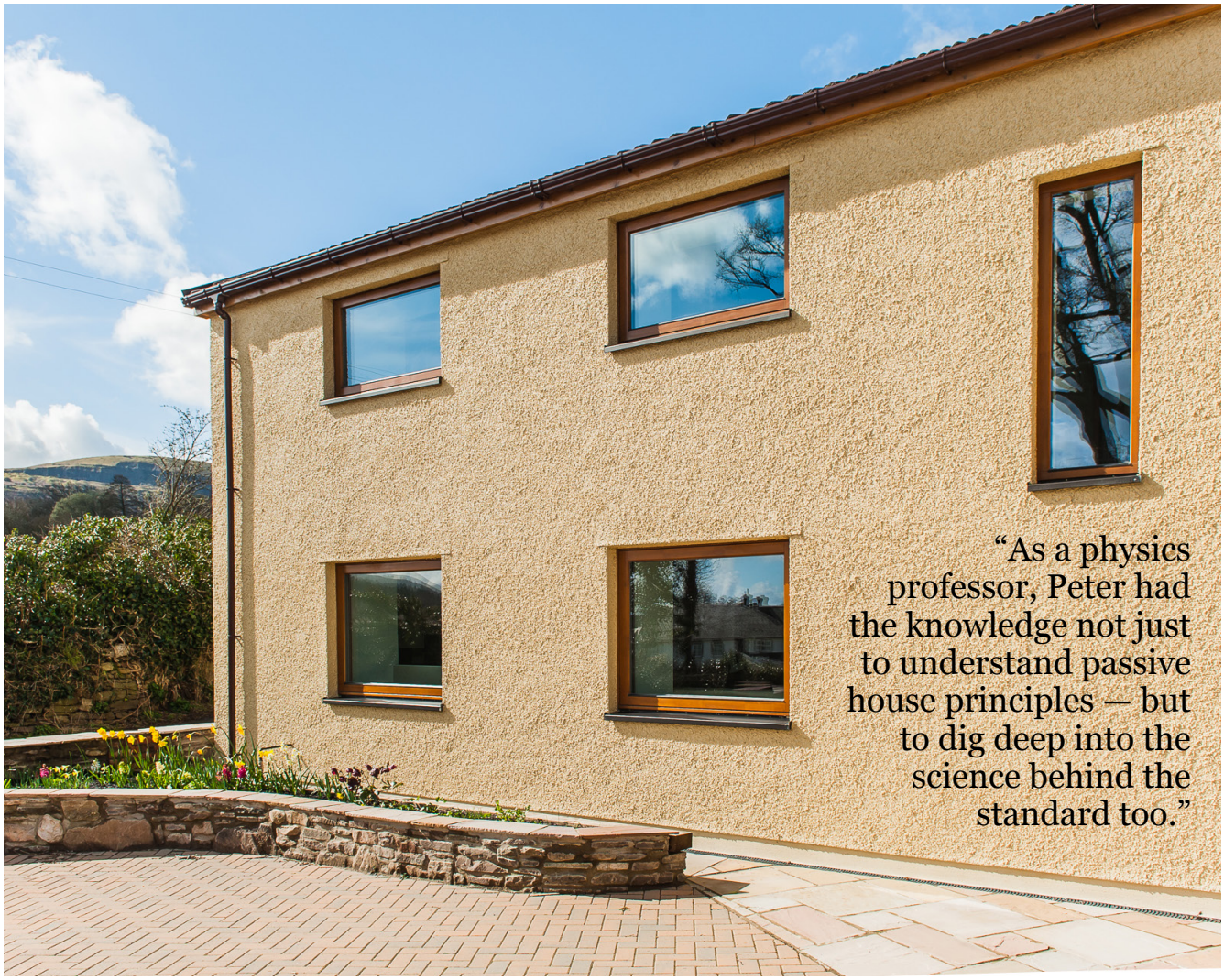
New windows & doors: Green Building Store Ultra triple-glazed timber windows with insulated frames, overall U-value of 0.8 W/m²K. Green Building Store Performance timber entrance door with overall U-value of 0.1 Wm²K.

HEATING SYSTEM
Before: Storage heaters and wood burning stove

After: Worcester Bosch Greenstar 12i (12kW) LPG boiler (supplied from 47kg cylinders), conventional radiators. Twin coil Greenstore cylinder, 2 x Greenskies solar thermal panels, ISM-1 interface with integrated FR110 controller.

Ventilation: Paul Novus 300 MVHR. Passive House Institute certified heat recovery efficiency of 93%.

Electricity: 2.4 kWp solar photovoltaic array (on outbuilding)



"As a physics professor, Peter had the knowledge not just to understand passive house principles — but to dig deep into the science behind the standard too."

18TH CENTURY RUIN

becomes stylish low-energy home

Homeowners Anne and Patrick Jordan's ambitious upgrade-and-extension project in County Kildare took the shell of an 18th century farmhouse and transformed it into an elegant family home with a striking-yet-sensitive modern extension — all while embracing a healthy and fabric-first approach to retrofit combined with clever heating system design that has brought them from a G to an A3 rating.

Words: John Cradden

Photos: Tomasz Juszczak / Imageworks

You can't see it when you turn off the main road and start driving down the short but narrow gravel pathway, but once past the forest of trees that hide this newly renovated 18th century farmhouse from general view, its tall four-storey structure reveals itself dramatically.

As first impressions go, it looks great. It's far more understated than you might expect a building like this to be — you might even describe it as minimalist, with its simple and subtle finishes. Pebble-dash may be out of fashion, but this building has an unpainted period roughcast finish that looks just right. The traditional white sliding sash front windows are beautifully painted and elegant, while everything else, including the front porch, the steps and the landscaping are all finished in the same subtle but tasteful theme.

But you're also looking at a historic building that has been retrofitted to a building energy rating of A3, a spectacular achievement in anyone's book. After all, there are a whole range of challenges involved in trying to undertake a deep energy retrofit on a building like this — and some building conservation experts would argue that you shouldn't even try to. So, how did the team behind the project — which included Maxwell Pierce Architects, Mesh Architects, and leading low energy builder Pat Doran Construction — manage to do it?

Part of the answer comes as the driveway sweeps to the far left side of the house, where a large, ultra-modern and multi-angled extension at the back gradually comes into view over the long and high rubble wall that fences off the rear of the property.

It's not the type of modern extension that is common on other historic buildings, which often feature a glassy tunnel-type link connecting the old building with what is essentially a brand new structure. This is a proper extension — it's all of one piece.

Looking at the technical specs, it's clear the new extension could probably achieve passive house certification on its own with its passive

slab foundations, triple-glazed windows, airtightness, and a highly angled design and orientation that seeks to maximise solar gain.

But while it turns out that a high BER rating was achievable for the whole building, striving for passive house certification would have made no sense because of the physical marriage between a modern high-performance extension envelope and an old-style, solid masonry, minimally insulated structure with traditional sash windows and a four-storey construction that is just one room deep, resulting in all the main rooms having three or four external walls (meaning there is a high surface-to-volume area from which heat can escape).

Architect Bill Maxwell of Enniskillen-based Maxwell Pierce has worked on plenty of historic buildings with extensions, but making such dwellings work as single, seamless entities from an energy and comfort point of view can be difficult — unless you also have the opportunity to strip the older building back to its bare bones and start again from scratch, as was the case here.

If this is not possible, he actively discourages adding modern extensions to historic buildings because of the propensity of the older buildings to devour heat. If the homeowners cannot make serious improvements to insulation and airtightness in the original building, they will have to continue spending huge amounts just to keep the temperature of the old, leaky house somewhere near that of the new, well-insulated extension.

“The wee pieces that we have added on as extensions umpteen times for listed buildings don’t have any huge positive impact on the overall property. The difference with the Jordans was that the extension became so much part and parcel of the house and we didn’t want to have that division between the old bit and the new bit.”

But what added a further difficulty to the deep retrofit of this particular near-300 year-old building was the zeal with which Kildare County Council required homeowners Patrick and Anne Jordan to preserve as far as possible its essential character and salvageable features. It turns out the local authority is more active in this regard compared with many others around the country, because so few historic buildings of any kind remain in the county.

When Patrick and Anne Jordan first spotted the house in 2009 (the couple and their five children were living just a few hundred yards away), it was in a bit of a mess, having been abandoned by its elderly owner a few years previously, and subsequently subjected to a period of continuous vandalism by students from a nearby secondary school before the windows were blocked up and the property made reasonably secure.

The couple bought the house and sat on it for a while before investigating the possibility of renovating it and adding a glassy extension. The house already had an ugly rear extension made out of pre-cast concrete that was grafted on in the 1920s, providing a plumbed toilet, kitchen and utility.

To this end, they consulted with a number of different architects, including one who had close links to Kildare County Council, and who persuaded them that the original structure was definitely worth preserving. But when they went to hire her services, she was all booked up — much to their disappointment. So they decided to knock the whole edifice down in favour of a new house of similar character.

“When we did that, Kildare County Council pounced and put a preservation order on it, despite there being no historical reference to or record of the building anywhere,” said Anne Jordan.

Although the couple conceded to KCC’s demand that they go back to their original plan to preserve and extend, Anne doesn’t hide her exasperation at the exacting and sometimes tedious demands of the building conservation procedure that followed, which included continuous consultations with the local authority as the project rolled along.

“We were told this house had to be tended to carefully, and that it needed a grade one architect, which is a load of whallop because it’s just a farmhouse, it’s not government buildings…Conservation is important, but we were trying to embrace new ways as well,” she added.

Sunni Goodson — an architectural conservation specialist with grade one architects Mesh — was appointed to be the main intermediary between the Jordans and the council. She readily concedes that the house is not a protected structure and that much of its historic fabric had been compromised, but says it was “still just a gem of a house”.

“The vaulted brick ceiling at basement level and a portion of the original staircase survived, as well as floor structures, chimney breasts and the 19th century front porch,” she said.

Before Kildare County Council intervened, the Jordans had hired Bill Maxwell to oversee a new build project, but his historic building experience would make him an even better choice when it became clear that a complete

(above) The house is ventilated via Lunos decentralised mechanical ventilation systems with heat recovery.

new build wasn't going to happen.

"One of the biggest challenges was getting an underfloor heating system into the fabric of the existing old building without completely destroying the historic fabric," said Maxwell.

Apparently this caused more than a few issues — joists were too narrow for the relevant pipes and had to be adjusted, and there were parts of the floor where joists needed steel reinforcements, lest the pipes should break because of excess movement.

"But we managed it," said Maxwell. "It was well worth it. Because without that it would have been a bit of an imbalanced arrangement."

It also meant that the Jordans could have the modern heating technology that they wanted. The system they chose is based on underfloor heating all throughout, driven by an Ochsner 18kW air source heat pump that features a separate horizontal split evaporator that sits outside the house. From a distance it looks like a large DJ twin turntable, and it was designed by Monaghan-based firm Eurotech in conjunction with Ochsner, with a view to taking advantage of the mild humid Irish climate. It boasts a co-efficient of performance of over 400%.

One advantage of a horizontally mounted evaporator, according to Eurotech's Gerry Duffy, is that at times of higher humidity, any excess water generated just runs off the table and onto the ground.

"Using floor heating in the existing structure allowed us design a system with very low-flow temperatures which is critical in dealing with old fabrics and heritage structures," said Duffy. "The very low design temperature of 30C flow max is enough to allow the entire structure to heat up and dry out without causing any damage, and at the same time repelling moisture and lowering humidity to a desirable level, perfect for comfortable living."

The system, which includes an 800 litre buffer tank and a 300 litre hot water cylinder with exhaust heat recovery from the bathrooms, is designed to ensure that the base temperature of the house never falls below 16C. The Eurosmart system has room-by-room heating controls, and features smart sensors that learn how each part of the building behaves (with their differences in building fabric, insulation, orientation etc) and adjusts the input of heat accordingly to achieve a consistent temperature throughout the building. Meanwhile, ventilation duties for both the new and old buildings are courtesy of a decentralised Lunos heat recovery ventilation system – a solution that enables low energy ventilation without running ductwork. The large house requires a dozen Lunos E2 decentralised heat recovery ventilation units, a Lunos Ego HRV unit and thee low energy extract fans.

Although the Jordans are only in the house a matter of weeks, Anne is delighted with the comfort levels throughout — particularly as the bedrooms of her five children are all in the old part of the building. Gerry Duffy estimates heating bills will amount to €700 a year for this 400 square metre property, which will be hugely impressive if he is proved right.

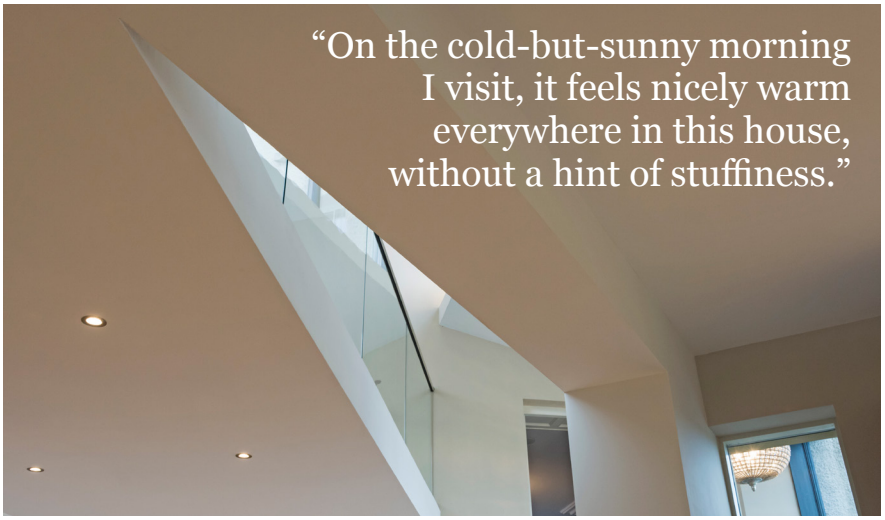
Of course, the upgrade to the fabric of the old building — and the new high performance cavity wall extension — are both vital for keeping energy costs down too. The old rubble limestone walls are thick but fairly porous, so it was essential to insulate them in a sensitive manner, using products that allowed them to "breathe" — in other words, that allow water vapour to pass through unimpeded.

"Fortunately there are wonderful new products on the market which can be used in a historic context, such as Gutex and Calsitherm, depending on the wall construction material and external finish. They are breathable products that significantly increase the building's thermal efficiency and the occupants' comfort, but they can also be finished with lime plaster," said Sunni Goodson.

The exact choice of insulation materials was determined by an analysis carried out by Joseph Little of the Building Life Consultancy. The 600mm-thick rubble walls were all boarded internally with 40mm of Gutex Thermoroom, with internal lime plaster as an airtight layer (the roofing throughout the building features Pro Clima membranes for airtightness and vapour diffusion). The whole house scored an airtightness result of 1.3 air changes per hour — an exceptional result for such an old dwelling, and such a complex project.

The work of project manager and contractor Paul Doran and his father Pat (both of Pat Doran Construction), was clearly crucial in meeting such remarkable levels, particularly when faced with the prospect of a building that Maxwell described as "an awful looking kind of haunted house ruin of a thing" — and making it airtight.

"Even with that starting point I was wondering could we achieve it," Bill Maxwell said. "And it was then down to getting the builder involved, and making sure that they were interested in it, and the Dorans were more than interested. So it was a good bit of teamwork."



"On the cold-but-sunny morning I visit, it feels nicely warm everywhere in this house, without a hint of stuffiness."

(below) the house is heated by an Ochsner 18kW air source heat pump, with features a separate horizontal split evaporator that sits outside the house. The system includes an 800 litre buffer tank and a 300 litre hot water cylinder with exhaust heat recovery from the bathrooms. Heat is distributed via underfloor heating circuits throughout all three floors of the house.

Under the Grey, there's still GOLD

Gold is changing to grey – and under the new paint colour there are some exciting major innovations!

Thanks to new platform thinking and enhanced manufacturing processes, we've been able to push product adaptability to the next level for the latest generation Gold air handling unit.

With increased product flexibility, it's more compatible for every project. More options, easier system design, and even better energy performance!

To find out more about our Passive House accreditation and new Gold Version F visit **www.swegon.co.uk**

www.swegon.co.uk

Swegon

Delivering sustainable construction

The Eco Refurbishment Company is a building company at the forefront of environmental construction and refurbishment, delivering sustainable construction solutions together as one complete package.

the eco refurbishment company

020 8786 7767 | www.eco-refurbishments.co.uk

Paul Doran said: "I think we did things the right way. We were very lucky in that the architect was committed and the quantity surveyor [Michael Broe] took a big interest and put a lot of time and effort and energy into it. And Anne put in an enormous amount into the project every day." The Dorans were undoubtedly helped by their experience on other challenging projects, drawing from a well of experience picked up on certified passive house and Enerphit projects, including a complex retrofit on Zion Road, Rathgar featured in issue 12 of Passive House Plus.

As part of the conservation tick-box, the sliding sash windows of course had to stay, although most were replaced. The Jordans were keen on double-glazed sash windows, but these would not fit into the narrow depth of the historic glazing bars. An expensive solution was Slimlite glazing, which is essentially two panes of glass held very close together.

At first glance, some might say the design of the roof looks unnecessarily complex. Maxwell said: "There's a reason that happens, which is just trying to get the line of the roof that abuts the back of the old house [to] tuck in between window sills, so that we didn't actually alter the openings in the back of the old house. Then that generated one angle, which led to another."

This is also the reason the extension is angled at around 45 degrees to the old building, which gives the light-filled space inside, including the kitchen and the mezzanine gallery above it, a peculiar triangular shape that works very well. You can also see the back of the old house very clearly from here too.

On the cold-but-sunny morning I visit, it feels nicely warm everywhere in this house, without a hint of stuffiness. It's something that clearly delights Anne and her family and allows them to enjoy the old and the new in equal measure, because it's all been done so well.

"What's actually rewarding about the building is the angles, because when you're inside, no matter where you stand, there are views everywhere," she said.

Standing in the utility room in the basement of the old building, I ask Anne if all the conservation rigmarole was really worth it. "Oh god it was worth it, jeepers yes. This makes the new part. It is so rewarding that it is warm and comfortable. I think if you're going to do it, it's important to do it right."

SELECTED PROJECT DETAILS

Clients: Patrick & Anne Jordan
Main architect (extension): Maxwell Pierce
Conservation architect: Mesh Architects
Contractor: Pat Doran Construction
M&E engineer: Eurotech
Civil & structural engineer: Brian Connolly Associates
Energy & building fabric consultant: Building Life Consultancy
Quantity surveyor: Michael Broe & Associates
Electrical contractor: Frank Knight Electrical
Ventilation: Partel
Airtightness tester & BER: 2eva.ie
Airtightness products & wood fibre insulation: Ecological Building Systems
Plastering & thermal breaks: D&M McKinney Construction
PIR insulation: Xtratherm, Quinn Therm
Windows & doors: Rationel
Sash windows: M&C Joinery
Curtain walling: Lakeside Windows

Want to know more?

The digital version of this magazine includes access to exclusive galleries of architectural drawings.

The digital magazine is available to subscribers on www.passive.ie

(left, top to bottom) the new roofs in both the old part of the house and extension feature Intello Plus vapour control membranes on the underside of the rafters, forming the primary airtightness membrane, with 40mm Gutex Thermoroom on the original walls; accommodating underfloor heating amidst the floor joists of the historic fabric was a major challenge; 30mm of QuinnTherm PIR insulation to the inside of the walls of the new extension, with battening for the service cavity inside this, and 600mm mineral wool to the flat ceiling above; (below left) the shell of the old house that the Jordans purchased prior to the retrofit; a vaulted brick ceiling is one of the original architectural features incorporated into the renovated property.

ecoVert Passive

is a Passivhaus new build and retrofit company based in the North West, with a passion for sustainable materials, timber-frame and modern methods of construction

t: 01244 940594
info@ecovertsolutions.co.uk
www.ecovertsolutions.co.uk

DESIGNER CERTIFIED PASSIVHAUS DESIGNER

Passivhaus Trust MEMBER

AECB building knowledge

Partel
Passive Building Supplies

New from Partel - the Lunos Nexxt fan

Applications:
- Residential
- Office
- School
- Hospitals

Nexxt is a decentralized heat recovery system that combines the benefits of ductless decentralized and centralized control systems. It enables control of ventilation in several rooms via just one unit, and is also the most silent unit of its kind, according to Lunos.

www.partel.co.uk - sales@partel.co.uk - 02037 401918

---

eurotech Renewables Ltd.
Renewable Heating Solutions

Tel: +353 42 974 9479

Oschner Air Eagle SCOP 4.5

Eurotech & Ochsner - Driving Energy Solutions

The new Ochsner Eagle Air heat pump is a revolutionary development, driving air source heat pump efficiency ahead of geothermal, SCOP 4.5.

Dressed in stainless steel, it sits quietly outside passing energy to the silent Ochsner internal systems.

The Oschner Eagle Air is the most efficient variable speed drive air/water heat pump on the market, silenty producing 65c all year round, increasing its output power as the weather gets colder. No back up required.

Eurotech Group provide sustainable heating solutions across Europe using Ochsner heat pumps to deliver the energy. We are renowned for our un-rivalled efficient systems in Houses, Churches, Schools, Apartments, Leisure Centres and Hotels.

designs@eurotech-heating.com www.eurotechgroup.ie

PROJECT OVERVIEW

Building type: Retrofitted 200 sqm rubble-built house (dating from c.1730) with approx 200 sqm cavity wall extension to the rear.

Location: Clane, Co. Kildare

Completion date: August 2016

Budget: Not disclosed

Passive house certification: N/A

Space heating demand (PHPP): 76 kWh/m^2/yr

Heat load (PHPP): 30W/m^2

Primary energy demand (PHPP): N/A

Airtightness: 1.3 ACH at 50 Pa

Energy performance coefficient (EPC): 0.493

Carbon performance coefficient (CPC): 0.532

BER: A3 BER (65.29kWh/m^2/yr)

Energy bills: €696.79 (estimated by Eurotech)

Airtightness (at 50 Pascals, after): 1.3 air changes per hour

ORIGINAL BUILDING (AFTER RETROFIT)

Thermal bridging: 40mm Gutex Thermoroom fixed to inside of all external 600mm rubble walls and running through all three floors from ground up to ceiling insulation. All sliding sash windows wrapped at reveals with 40mm Gutex. 50mm PIR insulation fitted between all joists under underfloor heating pipes on all three floors and connected back to 40mm Gutex on walls.

Ground floor: 120mm Xtratherm Thin R, underfloor heating pipes and 50mm floor screed. **U-value:** 0.16 W/m^{2}K

Walls (before): 600mm rubble wall. **U-value:** 2.1 W/m^{2}K.

Walls (after): 600mm rubble wall, lime plastered on the inside for airtightness, 40mm Gutex Thermoroom internally over first fix wiring, base coat, mesh and lime skim render. **U-Value:** 0.66 W/m^{2}K. No more than 40mm Gutex permitted due to condensation risk analysis by Building Life Consultancy.

Sloped ceiling/roof: Blue Bangor roof slates externally on 50x35 battens/counter battens, followed underneath by Pro Clima Solitex breathable roofing underlay, 180mm Isomer Metac fitted between rafters, Intello Plus airtight membrane stapled to underside of rafters internally, 50mm service cavity insulated with Isover Metac, 12.5mm plasterboard ceiling internally. **U-value:** 0.17 W/m^{2}K

Flat ceiling: Blue Bangor roof slates externally on 50x35 battens/counter battens, followed underneath by Solitex breathable roofing underlay, 400mm Isover mineral wool fitted above the collar, Intello Plus airtight membrane stapled to underside of rafters internally, 50mm service cavity uninsulated,12.5mm plasterboard ceiling internally. **U-value:** 0.13 W/m^{2}K

Windows: Solid timber sliding sash windows with seals and Slimlite glazing. **U-value:** 2.8 W/m^{2}K

NEW EXTENSION

Thermal bridging: KORE Passive Slab L Shaped Profile connecting 300mm EPS beneath the floor with 100mm CavityTherm in extension walls, windows fitted within cavity wall insulation and sitting on EPS sills, 180mm Metac at wall plate connecting 100mm CavityTherm in walls to 400mm mineral wool in flat ceilings/Gutex & Metac in sloped ceilings. 30mm PIR sheets fully fixed to wall, connecting to 50mm insulation on underfloor heating on first floor, and connecting to 400mm Metac mineral wool in ceiling.

Ground floor: Raft Viking passive foundation system insulated with 300mm EPS. **U-value:** 0.10 W/m^{2}K

Walls: Cavity wall with 100mm full-fill CavityTherm insulation, sand and cement airtight layer internally, 30mm Quinn Therm PIR to inside of walls, 22mm battens fixed forming service cavity, 12.5mm plasterboard. **U-value:** 0.14 W/m^{2}K

Sloped ceiling/roof: Zinc sheeted roof on 50x35 battens/counter battens, followed underneath by Solitex breathable roofing underlay, on top of 60mm Gutex woodfibre board, 220mm Isvmer Metac insulation fitted between rafters, Intello Plus airtight membrane stapled to underside of rafters internally, 50mm service cavity insulated with Isover Metac, 12.5mm plasterboard ceiling internally. **U-value:** 0.12 W/m^{2}K

Flat ceiling: Zinc sheeted roof on 50x35 battens/counter battens, followed underneath by Solitex breathable roofing underlay, 400mm Isover mineral wool above the ceiling joists, 200mm between the joists, Intello Plus airtight membrane stapled to underside of joists internally, uninsulated 25mm service cavity, 12.5mm plasterboard ceiling internally. **U-value:** 0.11 W/m^{2}K

Windows: Rationel Aura Plus triple-glazed aluclad windows, with argon filling and an **overall U-value of** 0.93 W/m^{2}K.

Curtain walling: APA TB50 aluminium-framed 5.6 x 3m high curtain walling screens manufactured and fitted by Lakeside Windows, triple-glazed with argon filling and an **overall U-value of** 1 W/m^{2}K.

Heating system: Ochsner 18kW water-to-water heat pump with COP of 421%, supplying Eurotech underfloor heating throughout the building (including all three floors of the original house). 800 litre buffer tank and 300 litre hot water cylinder with exhaust heat recovery from the bathrooms.

Ventilation: Lunos decentralised demand-controlled heat recovery system throughout. 12 x Lunos e2 units, 1 x Lunos Ego, and 3 x low energy extract fans. Final calculated efficiency relative to the house: 85.22% (according to DiBT) / 73.22% (according to the Passive House Institute). **Overall volume flow:** 195 m^3/hr. Specific power consumption of heat recovery units: 0.10 W/m^3/hr.

Together in *Electric Dreams*

The gradual decarbonisation of our electricity grids — as renewable energy is phased in, while coal and peat are phased out — coupled with the proliferation of new buildings with very limited heat demand, has some experts asking if heating our homes and offices directly with electricity is starting to make sense again. So is it time to bring back the dreaded storage heater?

Words: Kate de Selincourt

If we want to keep the planet liveable, we have to dramatically cut the amount of energy buildings use — and dramatically cut the carbon emissions from the energy demand that's left.

Good building fabric design (and refurbishment) dramatically cuts the need for heat, but in the UK and Ireland even passive buildings usually need some heat — and of course all dwellings need hot water. This means that heat has to be decarbonised, even in a passive house.

While there are well-established technologies to produce electricity without fossil fuels, heat has yet to decarbonise in the same way. Various reports on this topic recommend expansion of low carbon networked heat and possibly the decarbonisation of gas (for example, by synthesising hydrogen via electrolysis using renewable power).

But these technologies are still underdeveloped. Synthetic gas is not produced anywhere at scale, while networked heat still tends to be powered by relatively high-emissions technologies, such as CHP and biomass. However, the most common proposed means of decarbonising heat is through electrification.

Electrification of heat raises a number of questions about the ability of our power systems to produce enough low carbon electricity and their capacity to transmit it (which I'll get to shortly). But it also represents something of a u-turn in building services design.

Electricity in Ireland and the UK is still generated in large part from burning fossil fuels, including some high-carbon coal and peat, in power stations that lose more than half their energy as heat. For this reason

Photos: xxxxxxxx

electric heating, particularly direct electric heating, has had a well-deserved reputation for being high carbon and inefficient.

The high carbon emissions, and relative inefficiency, of electricity generation is recognised by the classic passive house standard, for which the high primary energy factor of grid electricity makes it hard to meet the standard using direct electric heat.

On top of the carbon and primary energy cost, direct electric heating — often by storage heaters — is notorious as a system that is cheap for a developer or landlord to install, but expensive and ineffective for occupants. Upgrading a house from storage heaters to gas central heating is still one of the most basic and widely accepted energy retrofit measures, especially when helping people in fuel poverty.

Heat pumps can overcome many of these issues, with the efficiency of a good unit more than making up for the losses at the power station. However heat pumps tend to be expensive, and if badly specified and set up, can leave users with high bills and/or cold buildings.

Gas combi boiler systems — familiar, cheap and simple to install — offer a comparable Sap score to a heat pump, and remain the default choice in UK residential construction when gas is available. (Ed — In Ireland, where a renewable energy contribution is mandatory under building regulations, heat pumps are becoming an increasingly popular choice. Data from SEAI's National BER Research Tool indicates that 28% of new homes built to date to the 2011 version of Part L use a heat pump as their main heating system, and anecdotal evidence is that this figure has increased dramatically recently due to more favourable treatment of heat pumps in the national methodology for calculating compliance with Part L, Deap).

Gas boilers have been a popular choice for passive homes as well, and LPG boilers (slightly higher carbon than natural gas) are sometimes specified where there is no mains gas, again, partly because of the simplicity and familiarity of the technology.

But with electricity grids decarbonising as more renewables come on stream, is it time to open our minds to electric heating once again?

Electricity decarbonisation is certainly under way. In Ireland the grid intensity has dropped from 0.642kgCO_2/kWh to 0.473kgCO_2/kWh since 2004. In the UK the grid average fell from 0.500kgCO_2/kWh at the start of this decade to 391g/kWh in 2015. Sap 2012, with its allocated grid intensity of 0.519kgCO_2/kWh, is already strikingly out of date in the UK.

With grid intensities falling, electric heating becomes less of a no-no. Although they may only 'break even' with gas in Sap, in reality heat pumps are now actually pretty low carbon. With a very achievable CoP of 2.5, a heat pump in the UK produces heat at around 0.150kgCO_2/kWh. This is distinctly lower carbon than gas which, in a good modern boiler, emits around 0.220 to 0.240kgCO_2/kWh delivered heat. Similarly, although grid carbon is higher in Ireland, a heat pump with a CoP of 2.5 still offers heat at around 0.180kgCO_2/kWh — a bit better than gas, and definitely an improvement on oil.

But heat pumps can be expensive. And if your building uses very little heat, is it really worth going to the expense and trouble of a heat pump installation, when direct electric heat is so simple and cheap to install? After all, grid electricity will continue to decarbonise.

Another issue with heat pumps is that when a building user has solar PV panels fitted, he or she naturally wants to make the most of the free electricity produced. One obvious way, especially if the building's occupants are out during the day, is to heat the space or the hot water for use later on. Heat pumps can be wired up to respond to signals from PV generation, but this is not a well-developed technology, and because heat pumps shouldn't really be cycled on and off too much, these systems need quite sophisticated controls.

By the time you have specified a heat pump and some controls that will talk to your PV — plus the correct emitters and a big low-temperature heat store to maximise your heat pump's CoP — you may have a lot of expensive (and possibly bulky) kit.

If heat demand is so low, is it possible there could be a case for the much simpler and cheaper approach of supplying direct electric heat for space and hot water? This might sound shocking — after all, grid CO_2 averages even in the UK are still higher-carbon than gas — but one or two designers are starting to consider it.

Nigel Banks, group sustainability director at community regeneration and housing contractor Keepmoat, looked at predicted UK grid intensities over the expected lifetime of a heating system installed now, in a paper for the CIBSE journal earlier this year. A system designed today will probably still be in operation in 2025, and according to the Department of Energy & Climate Change's projections, we can expect grid intensity then to be 0.165kgCO_2/kWh — undercutting the emissions of gas even without the use of a heat pump.

Eight years is such a short time in the lifetime of a building — or a heating system — that Banks believes we should be rethinking our policies now. "Many electric storage heating systems are being replaced with local gas boilers (or gas district heating), which over the next 12 years will increase emissions by 28%, and not deliver the 52% emissions savings projected by SAP 2012," he warns.

But there are issues with the running costs — and indeed with heating effectiveness — of electric heating, which can only really be addressed by upgrading building fabric. But this needn't be an issue with a well-insulated new build envelope.

"Direct electric heating used to be thought of as absolutely criminal. People see it as really expensive and of course it is, if you use it in the wrong sort of house, it is dreadful. But it now has a place I think," he says.

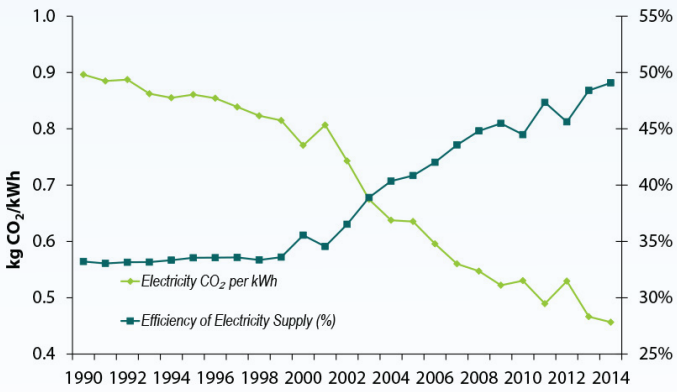
Banks is interested in using direct electric heating to tie in with the possibilities of the smart grid (more of which below). But there are other potential advantages, relating to the cheapness and simplicity of installing such systems.

This possibility is being pondered by the design team behind the proposed Enerphit retrofit of a small block of single-person flats In London, with vulnerable, low income occupants.

Unsurprisingly, the familiar approach of installing gas combi boilers for heat and hot water works perfectly well from a primary energy point of view in the classic version of the passive house standard.

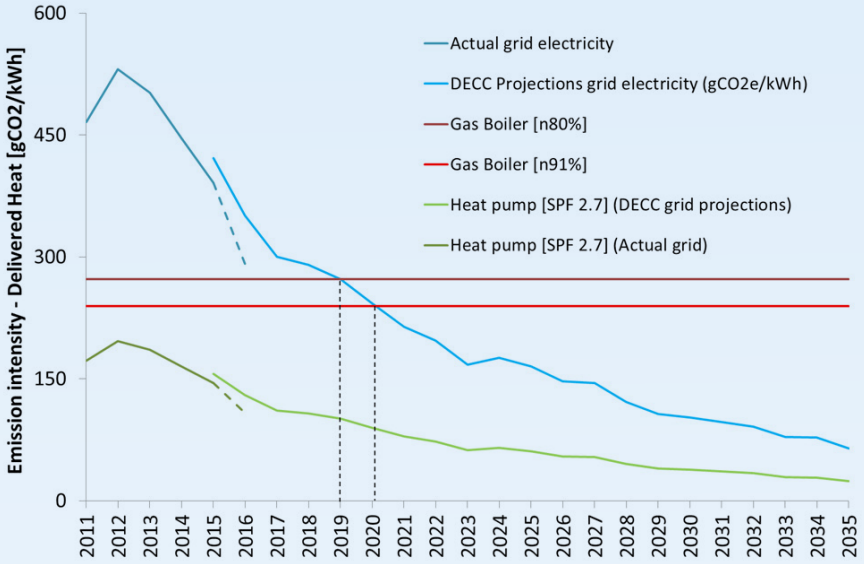
However, there are reasons this approach might not work so well for the occupants.

CO_2 Emissions per kWh and Efficiency of Electrical Supply 1990 – 2014



- The efficiency of electricity supply increased to 49.1% in 2014 while emissions from electricity generation fell to a record low of 457 g CO_2/kWh.

Grid emissions and efficiency in Ireland 1990 - 2014 (SEAI)



Grid emissions and projected emissions, UK, with gas boiler emissions for comparison

Though gas is superficially cheaper, the landlord is concerned that because of their acute fuel poverty, some occupants may self-disconnect from their gas supply altogether (by closing their accounts or not feeding their meters) and thus live with no heat or hot water at all.

With such small flats, and tenants on such low incomes, paying a second standing charge – or topping up a second meter – was too often unaffordable. While bills will fall after the retrofit, the standing charges wouldn't, with the risk that occupants would continue not to use their heating.

The team has thus considered options for electric heating instead. Heat pumps are under consideration, but these can be hard to install in apartments (and at 40 square metres, these apartments really are tiny). So what about direct electric heat?

The high primary energy factor for electricity means that a retrofit with direct electric heating and hot water stands no chance of meeting the usual requirements for Enerphit certification. However, passive house services designer Alan Clarke looked at the new passive house standards — 'plus' and 'premium' — and modelled the primary energy of the flats based on their primary renewable energy (PER). He found that with this approach, and the addition of a modest 1.5kW of solar PV for each flat, the design would meet the Enerphit standard with direct electric heating and hot water.

The design met the standard, even though the maximum allowed primary energy using the PER calculation is a lot lower: just 70 kWh/m^2/yr, as against the 135 allowed for Enerphit under the standard calculation. The reason it passed is the greatly reduced primary energy for electricity in this new standard. While the overall primary energy limit has gone down, the primary energy of grid electricity has gone down even more.

These dramatic reversals in primary energy allocations arise because the new passive house standards are looking forward not just one decade, but right the way through to a fully renewables-driven, zero carbon electricity system — and allowing designers to equip their buildings to perform as well as they possibly can in this future scenario.

In this ideal future, electricity is anticipated to come from a variety of renewable sources such as solar, wind and hydro — varying in proportion according to location and season. Having been generated renewably, there are no longer the huge thermal losses seen with gas and coal fired power, so the primary energy factor is a great deal lower.

Power that is used at the same time as it is generated is accorded the lowest primary energy (or, primary energy renewable, PER) factor. But if power is used when there is anticipated to be a deficit of generation, it is assumed that to fulfil the demand the grid will need to call on energy storage, so power at these times has a higher PER, reflecting the inherent losses in storing energy and re-releasing it later.

To track this more accurately, different uses (such as space heat, hot water etc) are allocated their own primary energy (renewable) factors, depending on how closely the timing of demand tracks the timing of likely renewable generation in that part of the world.

Under this approach, gas becomes the high primary energy option. It is assumed to be totally renewable, and mostly synthesised (either as hydrogen or methane) using renewably generated power, in a process that inevitably entails conversion losses.

Can smart devices help?

The energy system envisaged by the new passive house standards is not yet close to becoming reality, even with the most optimistic outlook. However, if you are smart about when you use electric heating, you can achieve further reductions in both carbon emissions and cost, even now.

This is an approach Nigel Banks at Keepmoat would like to trial. He believes that in a well-insulated fabric, the house itself, and the hot water tank, could take power from the grid when it is cheap and low carbon (these tend to go together) and store both until needed.

"You don't necessarily need to draw the power exactly when you want the heat, especially if your insulation and airtightness levels are near passive house, with MVHR installed. So long as you don't leave all the windows open, a building like this will retain the heat — temperatures will float within a band of around one degree and occupants will be comfortable."

Banks believes we can go a great deal further than just an Economy 7 style setup with its fixed allocation of the same seven "off peak" hours every night. Direct electric heating systems could be repeatedly switched off and on, controlled by sub-second signals from the grid reflecting the balance between supply and demand, offering grid operators an instantaneous grid balancing service — and all much quicker than powering a thermal power station up or down. These signals would be automatically received via rises and falls in grid frequency — heat pumps can't respond so quickly, which is why direct electric equipment is potentially so interesting, Banks says.

This approach is also being trialled by the EU Horizon 2020-funded RealValue research project. Manufacturer Glen Dimplex is working with the electricity supply chain and a number of tech companies and researchers in three jurisdictions – Ireland, Latvia, and Germany – to investigate the potential for the storage of surplus renewable generation as domestic heat. The intention is to fit up to 1250 homes with programmable storage and/or immersion heaters, which will be sent a signal to draw power to store as heat, when renewable generation is in surplus.

This more sophisticated control of electricity use, known as demand side response (DSR) — because it is customers balancing the grid by changing what they use, rather than generators changing what they generate — is thought by many to be an essential ingredient in a cost-effective low carbon electricity grid of the future.

As a report to the Department of Energy & Climate Change explains, DSR can balance electricity supply and demand, both on very short or longer timescales. At the same time, by reducing peaks on the networks, DSR can reduce grid reinforcement costs. The savings can be shared between the utilities and their customers.

Heat pumps could one day participate in the smart grid too. While heat pumps can't switch instantaneously enough to respond to sub-second frequency changes, with the right electronics they could respond to less frequent signals (perhaps via the internet), with a timeframe of say five minutes or more, according to heat pump expert John Cantor.

Not just a smart grid, a fair grid

Unfortunately, one of the obstacles to uptake of these clever new systems is likely to be the experiences people have had of the original "smart tariff", Economy 7. The tariff has too

often been paired with storage heaters and hot water tanks that don't store heat for more than a few hours, in homes with desperately leaky fabric. Research by Reading University has found that many users had such poorly set up immersion systems that they could not take advantage of Economy 7 at all — "tanks were heating up and cooling down before they got the hot water". The Economy 7 tariff ended up effectively being a way for electricity companies to charge people once to heat the landing (or indeed the sky) overnight, with another chance to charge over the odds for some on-peak electricity, when heat was actually needed.

Citizens Advice adds that some people weren't using the cheaper electricity at all: "Of consumers with Economy 7, 38 per cent were recently found not to have a storage heater or run any of their appliances at night, therefore paying more than they need to, to the advantage of no one but the energy companies."

Is this the right approach?

Even if the way electricity is sold can be made more equitable, should we really be encouraging people to use it more? Certainly not everyone is convinced by the brave new world as envisaged by the passive house PER approach.

Sally Godber of Warm thinks it's too soon to be designing buildings for a fully renewable grid scenario that is not expected for perhaps another 30 years. "Most of the heating equipment that we are specifying now won't last that long," she points out. "Although in 30 years time electric heating might be reasonable, by then all the systems we are installing now will be due for replacement anyway. "

Godber does not believe it is yet time to write off instant gas heat, with its lack of storage issues – or indeed district heating, where, she says, the shocking inefficiencies of the recent past need not necessarily continue in future. "I think putting wet heating into buildings now is no bad thing. Anything can heat it, be it a heat pump, district heating or whatever is best in future."

Energy consultant David Olivier has long been critical of the drive to go all-electric, and previously wrote in Passive House Plus questioning the wisdom of encouraging more electricity use during the winter, and indeed, high electricity exports on summer days (ie from solar PV), given limited UK network capacity and the lack of economical storage methods.

Decarbonised electricity certainly cannot be seen as a substitute for demand reduction — this is a danger with policy making that led us to previous nonsenses such as the UK's failed zero carbon standards. By contrast, electric heating of well-insulated buildings is not expected to pose additional challenges for grid infrastructure, which power companies will have to reinforce anyway to meet the demand from electric vehicles.

As James Bennett of Western Power Distribution explained: "What really worries us is the prospect of everyone coming home from work and plugging in their electric vehicles at the same time."

In highly insulated dwellings, power would not necessarily need to be drawn down during times of peak demand, given that the better insulated a building is, the more flexible it can be about when it receives heat — without impacting on the comfort of occupants. Such buildings could probably take power during demand lulls in the early afternoon and overnight, when if anything the demand may come as a relief to the grid.

So what should we be specifying?

Direct electric heating might not be the best choice purely from an energy and cost point of view (and it is unlikely ever to beat a heat pump), but it's a lot less unthinkable than it used to be.

Decisions about the design of building services, as with all aspects of a building, must take into account carbon and sustainability, but also affordability to the occupants, and the preferences and budget of the client. For example, if the specification of a slightly cheaper, though higher-carbon, heating system allows room in the budget for equivalent energy savings to be made in the building fabric, that might be worth considering.

Whether you feel this is a defensible route from the carbon point of view probably depends on your confidence in the continued decarbonisation of the grid, and your expectation for the lifetime of your heating system.

If you agree with Nigel Banks, writing in the CIBSE Journal that "heating systems being designed today will mostly spend their operating lives in a time with UK grid intensities below 240g CO_2/kWh — the carbon intensity of heat delivered from a 91% efficient natural gas boiler" then as he says "this has a fundamental impact on how we should design, heat and manage energy in our homes and buildings." If you are feeling gloomier (and it's by no means a uniformly heartening picture) you might be more inclined to stick with what you know.

Your preferences might also depend on your optimism about the 'smart grid' and what sort of building services can work best with this. But already, grid intensity at night often drops to around 260g/kWh in the UK, suggesting that if electric heat is taken predominantly at night, it comes even closer to matching the carbon intensity of gas.

In the absence of a coherent, active strategy for heat decarbonisation, perhaps it is pointless to expect to know which is the "correct" heating system to specify right now — though we can probably start to look a bit more favourably on electric systems. Where we get the opportunity, we can also give demand side response a go: not because it is guaranteed to reduce the carbon footprint of a building, but because we need people to trial it and improve it to make it work.

What we do know though, is that as building designers, builders and users, if we want to see heat decarbonised, we should continue to work hard minimising energy use wherever we can. Less energy demand means less pressure on electricity grids to rely so heavily on fossil fuels. In this way, we are playing a crucial part in driving grid carbon down, and getting a bit closer to the future we'd like to see.

the magazine you've been waiting for is here!

passive house+

eco build & upgrade

subscribe for only £20*!

subscribe to Passive House Plus **6 issues delivered to your door**

Name: _____

Position: _____

Company: _____

Address: _____

Tel: _____ Fax: _____

Email: _____ Web: _____

Type of business: _____

Number of copies required: ☐ Signature: _____ Date: _____

☐ I enclose a cheque **£20 (€45 outside UK & Ireland)** made payable to Temple Media Ltd.

OR please debit my: ☐ Visa ☐ Master card

Card number: ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ CCV no: ☐☐☐

Expiry date: ☐☐ / ☐☐

Name of cardholder: _____ Signature: _____

Tel: +353 (0)1 210 7513 Email: oisin@passivehouseplus.ie Subscribe online at www.passivehouseplus.ie

TEMPLE MEDIA LTD., PO BOX 9688, BLACKROCK, CO DUBLIN, IRELAND

Over 21 years' experience in bringing together builders, architects, designers, engineers, manufacturers, housing associations, local authorities and interested individuals to develop, share and promote best practice in environmentally sustainable building.

AECB

building knowledge

Why join the AECB?

- **Networking** with some of the UK's leading ecobuilding practitioners
- **Passivhaus Trust** discounted membership
- **Online forum** with the opportunity to drive best practice forward
- **Local group meetings** and events to meet up with other AECB members
- **Passive House Plus Magazine** subscription for ecobuilding news, articles and case studies
- **Annual conference**
- Library of **Technical papers** including the **CarbonLite programme**
- **Discounts** on a wide range of products and services

Full details on how to join:
goo.gl/VKNJJP or scan QR code:

the Association for Environment Conscious Building

AECB
PO Box 32, Llandysul, UK, SA44 5ZA
t: 0845 4569773 w: www.aecb.net

Help Desk

How to prepare to deliver nearly zero energy buildings

In the second instalment of this column, architect and DIT lecturer Simon McGuinness outlines the key priorities for the industry to learn in order to deliver successful ultra low energy buildings in 2017 and beyond.

What skills do you need to implement the European nearly zero energy building (NZEB) standard successfully? The operative word in this question is "successfully". NZEB is easy to get wrong. As the EU commission envisions it, NZEB is a radical leap forward in how we build and measure buildings. In some respects, it is a leap into the dark. We have discovered, and are still discovering, gaps in our knowledge: the so-called "known unknowns". No doubt these will expand in the future as we discover "unknown unknowns" along the way. So far, what we are fairly sure about is that there are eight key skills required to deliver NZEB, successfully:

1. *Geometry / form factor optimisation*
2. *Overheating potential assessment*
3. *Condensation risk analysis*
4. *Cost optimality evaluation*
5. *Thermal bridge calculation*
6. *Ventilation design and implementation*
7. *Airtightness design and installation*
8. *U-value & building heat loss calculation*

I have listed these in order of my current estimation of their acceptance in the construction industry from least understood to best understood. Training schemes are available in most European countries in the lower two skills, with good ventilation design still something of a "Cinderella" industry in many countries. Anything above these basic skills is generally regarded as of academic interest only. Or could be categorised as "unknown".

This is a serious strategic mistake as the list is also very approximately organised in terms of likely cost impact on a lifecycle basis. The higher up the list you go, I would argue, the greater the potential societal cost of getting this aspect of NZEB wrong. On a cost-benefit basis, we should be starting near the top of the list and working down; we seem to be doing the opposite. That is because we are focused on the things we know we can do now, rather than the things we most need to do.

Nor can we afford to work our way up the list incrementally, gradually expanding our knowledge along the way. This gets us into the difficulty illustrated in several recent UK studies, predicting increasing respiratory disease in the population as a result of mould growth due to our primary focus on heat loss. Thus, human health suffers and we have to fix humans as well as fixing mouldy buildings.

Similarly, had we solved the thermal bridge issues, we may not have needed quite so much insulation in the first place. Or if we assessed the interstitial condensation correctly, we would not in future have to replace the rotting timbers that the ill-considered application of internal insulation may produce, nor treat the occupants for their respiratory diseases[1]. And, if we solve the complex overheating equations before we do any of the other measures, we may avoid a future epidemic of air conditioning retrofits prescribed by medics to prevent excessive summer deaths during increasingly frequent heat waves. Needless to say, adding air conditioning has the potential to undo much of the heating efficiency gains claimed on the way up the incremental ladder. Is this yet another "unknown unknown" or an eminently predictable reality? Either way, it is expensive to fix after the event, but easy to avoid with foresight and a suitable spreadsheet.

You may be wondering about geometry. This is top of the list for one reason: it's free. There is no more impactful low-cost measure than avoiding heat losses (or gains) by having an efficient envelope shape. Studies carried out at DIT indicate that 30% of fabric heat loss can be eliminated by simplifying the building shape[2]. This may require a new architecture if, as architects claim, form follows function; an architecture fit for the Anthropocene[3].

This is traditionally a good time of year to take stock and plan for the future, make new year resolutions, promise to do better, to be better. What I have outlined above is the biggest peace-time upskilling of an industry ever contemplated. All of this needs to happen in an industry notorious for its inability to attract or retain skilled labour[4], an industry characterised by short-term employment, bogus self-employment and repeating catastrophic financial collapses. If that were not enough of an obstacle to upskilling, the industry is on the cusp of digitisation. Digital technologies will cause as much disruption of the construction industry as the MP3 digital format did in the music industry. In that case, global revenues halved[5] leading to widespread bankruptcies. Start-stop policies from governments[6], more, or increasing, less convinced of climate change, are relatively insignificant given the background turmoil. Now would be a good time to plan for acquiring some new qualifications in both NZEB and the brave new world of digital construction. Happy new year.

1 *Shrubsole et al. (2015). A tale of two cities: comparative impacts of CO2 reduction strategies on dwellings in London and Milton Keynes. Atmospheric Environment, 120, 100–108. https://goo.gl/d6kKrF*

2 *Ledwith, D (2012) https://goo.gl/sU2oza*

3 *The Anthropocene epoch: scientists declare dawn of human-influenced age, UK Guardian, Monday 29 August 2016 https://goo.gl/voJ3GT*

4 *Farmer, M. (2016). Review of the UK Construction Labour Model, UK Government, https://goo.gl/XjTvFq*

5 *Smirke, Richard (March 30, 2011). "IFPI 2011 Report: Global Recorded Music Sales Fall 8.4%; Eminem, Lady Gaga Top Int'l Sellers". Billboard Magazine. Retrieved July 18, 2012.*

6 *Government kills off flagship green deal for home insulation, UK Guardian, Thursday 23 July 2015. https://goo.gl/8H5VGF*

Want to ask Simon a question? Email ***helpdesk@passivehouseplus.ie***

products and technical support

for Passivhaus and low energy buildings

Free Passivhaus CPDs for building professionals – book yours today!

- Windows & doors
- MVHR heat recovery ventilation
- Airtightness & insulation

Photo: Eastlands Homes

> **“Green Building Store very much worked with us as one of the team”**
>
> **Eric Parks** and **Nittai Edelmann (2e)**
> Architects, Erneley Close EnerPHit

green building store®

Making buildings better

Call us to arrange your free Passivhaus CPD or to discuss your project on **01484 461705** or go to **www.greenbuildingstore.co.uk**

Sole suppliers and distributors in the UK for:

pro clima®
Intelligent airtight and windtight building systems
Internal and external, membranes, tapes, glues and accessories

GUTEX®
NATURALLY MADE FROM WOOD
Vapour permeable wood fibreboards for insulating roofs, walls and floors

CALSITHERM
CLIMATE BOARD
Internal calcium silicate boards, plaster and accessories - ideal for renovation

esb
elka strong board
High performance, diffusion open, structural, wood particle board

DIASEN
IMPROVE YOUR BUILDING
Eco-friendly, lime, cork based thermal plaster systems

THERMO JUTE 100
Natural insulation made from Jute

wellhöfer
ATTIC HATCHES
Pre-insulated airtight attic hatches

optime
BRIGHT IDEAS
Airtight down light protector housing units

ecological
BUILDING SYSTEMS

Airtight, Windtight & Natural Insulation

Products & Training

We're experts in airtightness and natural insulation and can help you to achieve a comfortable, healthy, low energy home with our range of ecological building products.

T 01228 711511
info@ecologicalbuildingsystems.com
www.ecologicalbuildingsystems.com